The Electrical Industry's Weekly Magazine July 10, 1961

Electrical World

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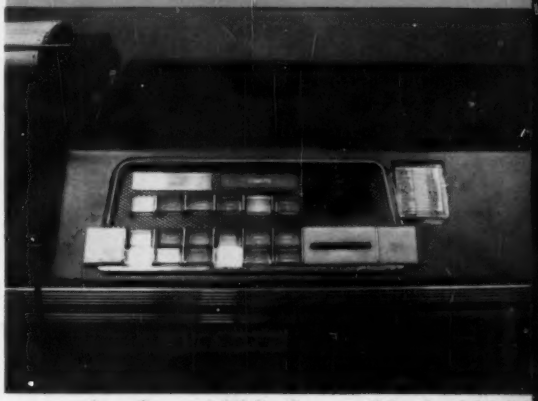

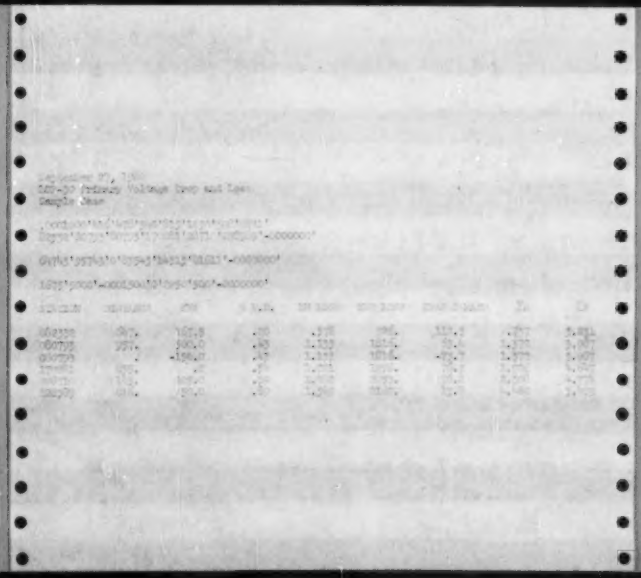

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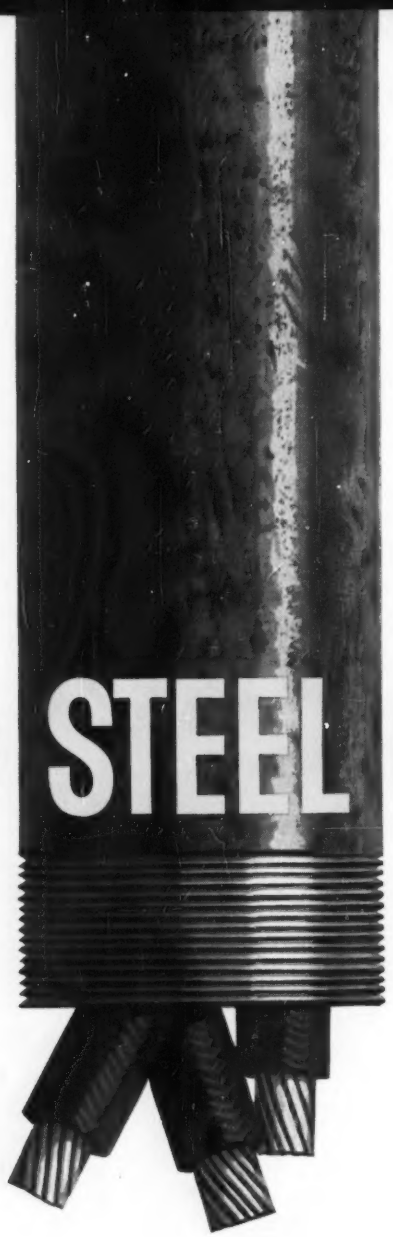

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Published for 87 years for those engaged in the business of generating, transmitting, distributing, or applying electric power

Electrical World

July 10, 1961
Vol. 156, No. 2

Dateline...

Will Compromise Affect Preference Clause?

Washington, D. C.—The preference clause seems to be nearing a junction in the road, as opponents and political considerations are sniping strongly today at what was originally a pure concept.

The future of preference appears to be either: (1) shake clear of the sniping and continue along the traditional path, at the possible expense of other public power gains; or (2) accept some modifications of preference here and there, with the possibility that too many changes could make the whole concept ineffective.

The term "area" is at the heart of the problem. It's a problem of individual preference system rights versus the rights of a number of preference systems in a broader area—an entire state, river basin, or region.

Long-distance federal transmission has brought the issue to a head because of the broader areas and political factors involved, and in turn, the controversial federal transmission grid, proposed by public power zealots, has the most at stake in keeping the preference clause status quo.

Compromises with the preference principle have been both made and proposed in the past, but in more limited areas. Now the Bonneville-California intertie could force a preference change that would have unavoidable, powerful impact on preference everywhere.

In an earlier day, the Hungry Horse project, Mont., had included language to limit the dam's power "principally" for use in Montana, to the possible limitation of preference customers elsewhere on the Bonneville system. And Montana legislators still feel Hungry Horse should be a precedent for new federal dams in their state, including Libby.

More recently, the late Sen. Richard Neuberger (D-Ore.) tried vainly to promote a "softening" of Bonneville preference to prevent "geographical inequities" in federal power during periods of short supply. He was concerned that the lack of preference systems in his state could work to Oregon's disadvantage if a shortage occurred.

Sen. Neuberger's plan was criticized by Gus Norwood, general manager of the Northwest public Power Assn: "It is usually our belief that the local interest, the regional interest and the national interest are the same."

Public power acceptance of any change in preference—keystone of its movement—seems to depend

(*Continued on page 5*)

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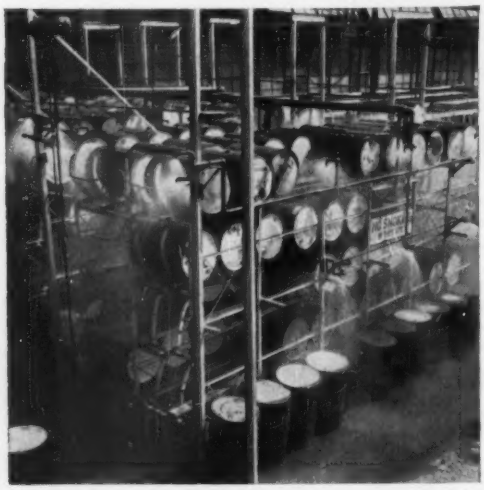
The basic fire extinguishing agents are shown on the chart below with the most common applications cross-referenced by check marks. If your process requires a specially designed system — the research and test facilities of the Grinnell Company stand ready to serve you.

Extinguishing blanket of foam completely covers the floor of this aircraft hangar. 5,897 foam-water sprinklers protect property worth a billion Air Force Defense dollars.



Water spray, applied to outside storage of paints and solvents, cools to inhibit internal pressure build-up and dilutes to prevent flammable vapor-air mixtures from developing.

SPECIAL FIRE HAZARD	WATER SPRAY	FOAM	CARBON DIOXIDE	DRY CHEMICAL
AIRCRAFT HANGARS	✓	✓		
ALCOHOL STORAGE	✓	✓	✓	
AMMUNITION LOADING	✓			
AMMUNITION MAGAZINES	✓			
ASPHALT IMPREGNATING	✓			
BATTERY ROOMS			✓	
CARBURETOR OVERHAUL SHOPS	✓	✓	✓	✓
CLEANING PLANT EQUIPMENT	✓	✓	✓	✓
DOWTHERM	✓			
DRYING OVENS	✓		✓	✓
ENGINE TEST CELLS	✓	✓	✓	
ESCALATORS, STAIR WELLS	✓			
EXPLOSIVES: MANUFACTURING, STORAGE	✓			
FLAMMABLE LIQUIDS STORAGE	✓	✓	✓	
FLAMMABLE SOLIDS STORAGE	✓			
FUEL OIL STORAGE	✓	✓		
HANGAR DECKS	✓	✓		
HYDRAULIC OIL, LUBRICATING OIL	✓		✓	
HYDRO-TURBINE GENERATORS	✓		✓	
JET ENGINE TEST CELLS	✓	✓	✓	
LIGNITE STORAGE AND HANDLING	✓			
LIQUEFIED PETROLEUM GAS STORAGE	✓			
OIL QUENCHING BATH	✓	✓	✓	✓
PAINTS: MANUFACTURING, STORAGE	✓	✓	✓	✓
PAINT SPRAY BOOTHS	✓		✓	✓
PETROCHEMICAL STORAGE	✓	✓	✓	
PETROLEUM TESTING LABORATORIES	✓	✓	✓	
PRINTING PRESSES			✓	
REACTOR AND FRACTIONATING TOWERS	✓		✓	
RECORD VAULTS			✓	
RUBBER MIXING AND HEAT TREATING	✓		✓	
SHIPBOARD STORAGE	✓		✓	
SOLVENT CLEANING TANKS		✓	✓	✓
SOLVENT THINNED COATINGS		✓	✓	✓
SWITCHGEAR ROOMS			✓	
TRANSFORMERS, CIRCUIT BREAKERS (outdoors)	✓			
TRANSFORMERS, CIRCUIT BREAKERS (indoors)	✓		✓	
TURBINE LUBRICATING OIL	✓	✓	✓	✓
VEGETABLE OIL, SOLVENT EXTRACTION	✓	✓		

There's a Grinnell Fire Protection System to protect your property. You benefit from over 90 years of fire protection experience when you rely on Grinnell. Send for this free 44-page booklet today. Write Grinnell Company, Providence 1, R. I.

Dateline . . .

Washington, D. C. (*Continued from page* 3)
on what is involved in exchange. Support for Hungry Horse was won by inclusion of the statewide language; Sen. Neuberger's proposed preference change was considered too high a price to pay in exchange for his "Bonneville Power Corp" bill, of which it was a part.

The proposed Bonneville-California intertie is pushing the point again. Public power leaders are realists, and they feel some sort of protecting legislation will approve the intertie. This "protection" would restrict preference system use of federal Bonneville power exported to California.

Bonneville has released its draft of a possible protection bill, to limit firm federal power to the Northwest, giving only short-term secondary power to California systems—preference and non-preference. Whatever version is finally approved by Congress will differ greatly from this draft. And approval may be a long time in coming. House Interior Chairman Wayne Aspinall (D-Colo.) has indicated he wants a long look at such a bill.

Little strong feeling has been registered either way on the draft. The REA opposes it. Nationwide public power sentiment tends to accept it only as a necessity in building the intertie. The Northwest varies between favoring the draft to feeling it isn't strong enough—but the Northwest also has broader concern for the whole intertie concept.

Behind-the-scenes jockeying is still going on as to the need and effects of this proposed change. Unanswered questions are: (1) Would this set a real precedent for other regions to demand similar protection, and what effect would this have on a federal power grid? (2) If power deliveries were reversed, would California have similar priority over the Northwest? (3) It is realistic that the government could cut off deliveries to a connected California preference system?

Letters

Charges Innuendo in Editorial

To the Editor:

I am distressed to see that your editorial of May 29 continues the tradition of inaccuracy and innuendo which has so long characterized the editorial pages of your magazine.

First, you refer to a team that inspected Soviet Union power facilities as being sponsored by the American Public Power Assn. We never sponsored such a team, and if you or your editorial writer had ever taken the trouble to read the report published by the group of which I was a member, it would have been obvious to you that APPA was not the sponsor of this group.

The fact is that this group was sponsored by the Interior and Insular Affairs and the Public Works Committees of the United States Senate pursuant to Senate Resolution 248 (Report No. 1926) and the trip was included under the East-West Exchange agreement. The 11-man delegation consisted of three United States Senators, four staff members of the two Senate committees, and four consultants, of whom I was one.

Secondly, you state that, "The APPA team wasted their opportunity, concentrating instead on drawing political advantage by lifting certain information inappropriately out of the context of the broad Soviet program."

As, I indicated earlier, you or your writer apparently did not read the group's report because you didn't even know who sponsored the team of which I was a member. However, had you read this 196-page report you would have noted that this group compiled a wealth of information on many different facets of the Soviet hydroelectric and water resources programs. A reading of this report would also have indicated that this group was directed by the United States Senate to study not only hydroelectric power, but the entire natural resources development program of the Soviet Union.

Speaking for myself, I can say that those of us who made this trip to the Soviet Union were considerably wearied from extensive travel of more than 12,500 miles within the Soviet Union, and I personally resent any implication that we wasted our time. Thirdly, you refer to "sincere" power men having brought back "a heretofore unavailable 'feel' for the sweep and motiva-

(*Continued on page* 116)

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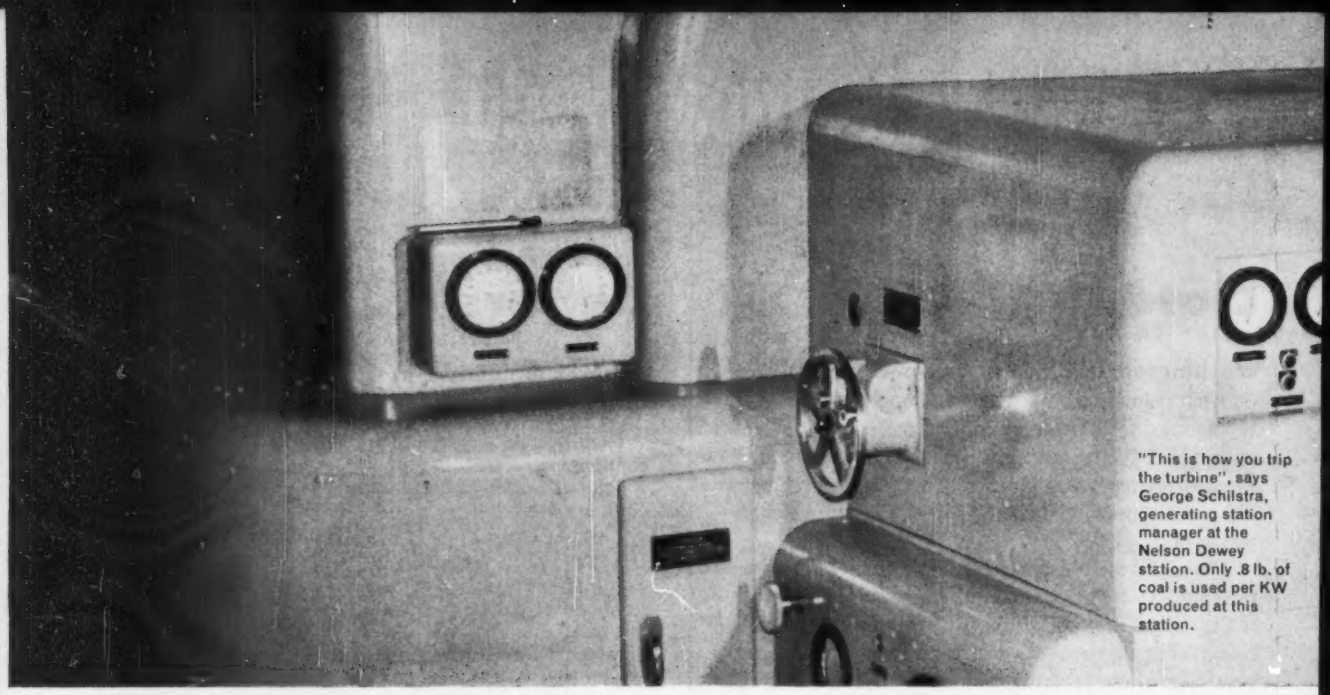


"This is how you trip the turbine", says George Schilstra, generating station manager at the Nelson Dewey station. Only .8 lb. of coal is used per KW produced at this station.

BY R. C. "ROLLY" BLEIMEHL

About the Author. Rolly Bleimehl has been providing technical service on lubrication to customers of our parent company for fifteen years. He has a mechanical engineering degree from Iowa State College and has completed the Company's Sales Engineering School at Whiting, Indiana.

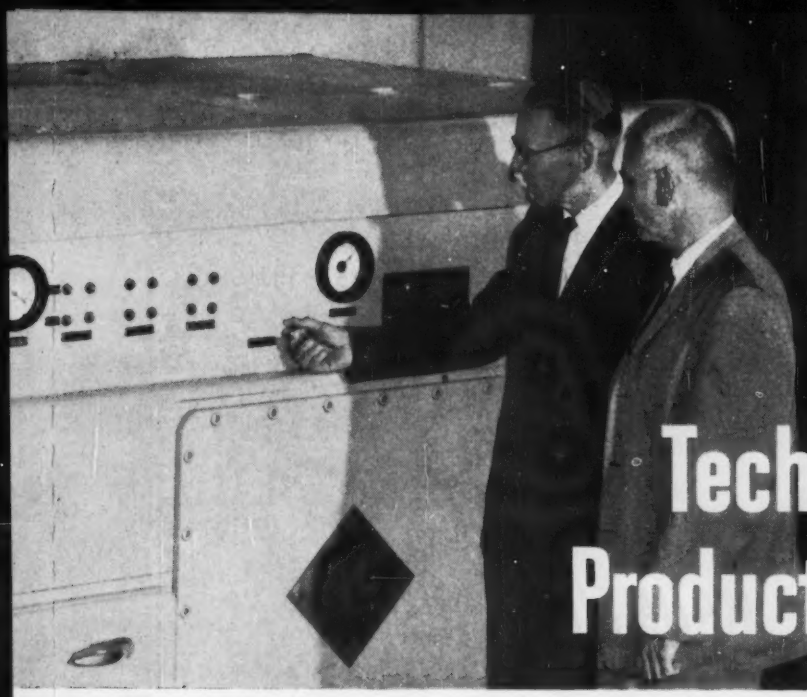
* * *

In 1954, when the first of two 75,000 KW turbines went into service at Wisconsin Power & Light Company Rock River generating station, Beloit, management had to make a decision on a turbine oil. Two factors helped them decide in favor of NONPAREIL Turbine Oil: (1) NONPAREIL's performance history and (2) the technical service available from American Oil Company.

Performance history: Each fill of NONPAREIL Turbine Oil carries with it a life-of-turbine guarantee. This means that if, during the life of the turbine, the neutralization number of the oil ever rises above the low limit of 0.15, the oil will be replaced free of charge. Some fills of NONPAREIL Oil have been in service more than 35 years under this life-of-turbine guarantee.

Technical service: I'm located at Madison, only a short distance from Beloit. Thus, I'm always handy to make periodic calls at the station to answer questions about the oil. And we take samples of the oil regularly for analysis at our Whiting, Indiana, laboratory (at no expense to the utility).

Putting these two together—product performance and technical service—Wisconsin Power & Light Company decided it made good sense to specify NONPAREIL Turbine Oil. The satisfactory performance of the oil in the first turbine at Beloit helped the management decide on



This is
AMERICAN OIL COMPANY
in action

Technical Service, Product Performance

it for the second 75,000 KW unit when it was installed in 1955. For the same reason management selected NONPAREIL when their 100,000 KW turbine went into service at the Nelson Dewey station, Cassville, Wisconsin, in 1959.

Get more information about NONPAREIL Turbine Oil and about the lubrication technical service that is available. Phone your nearby American Oil Company office.

Quick facts about **NONPAREIL Turbine Oil**

- Will not permit formation of harmful acids.
- Will not permit formation of sludge or oil varnish.
- Will maintain good demulsibility or water-separating characteristics.
- Has high resistance to foaming.
- Contains adequate rust inhibitor.

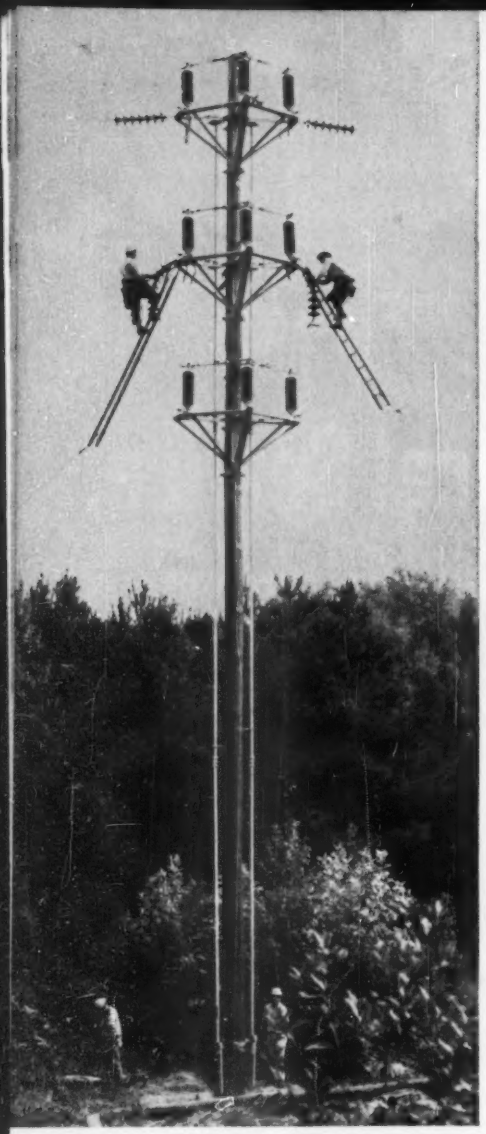
AMERICAN

AMERICAN OIL COMPANY
910 S. Michigan Ave., Chicago 80, Ill.

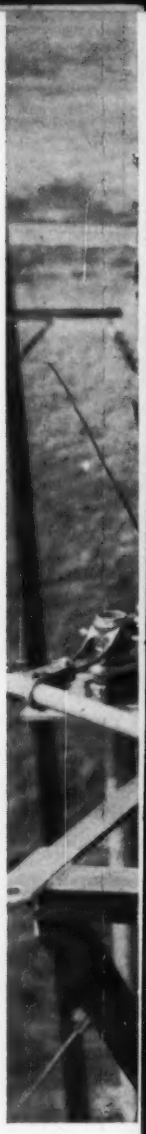
--two reasons why this utility selected

NONPAREIL Turbine Oil

Leslie Hoffman (right), Rock River generating station manager, goes on an inspection tour of one of two 75,000 KW turbines with American Oil's Rolly Bleimehl. Rock River is the largest station in Wisconsin Power & Light Company system.



EXCLUSIVE MOUNTING SYSTEM SPEEDS ERECTION OF SOUTHERN STATES' POLE-PAK



MINIMUM CREW TIME is needed to install Southern States Pole-Pak Air Switches. One pole is all that's needed for three-way switching, compared with conventional arrangements requiring up to six poles. Limited land requirements offer opportunities for installations where other types are not possible. Savings can be substantial.

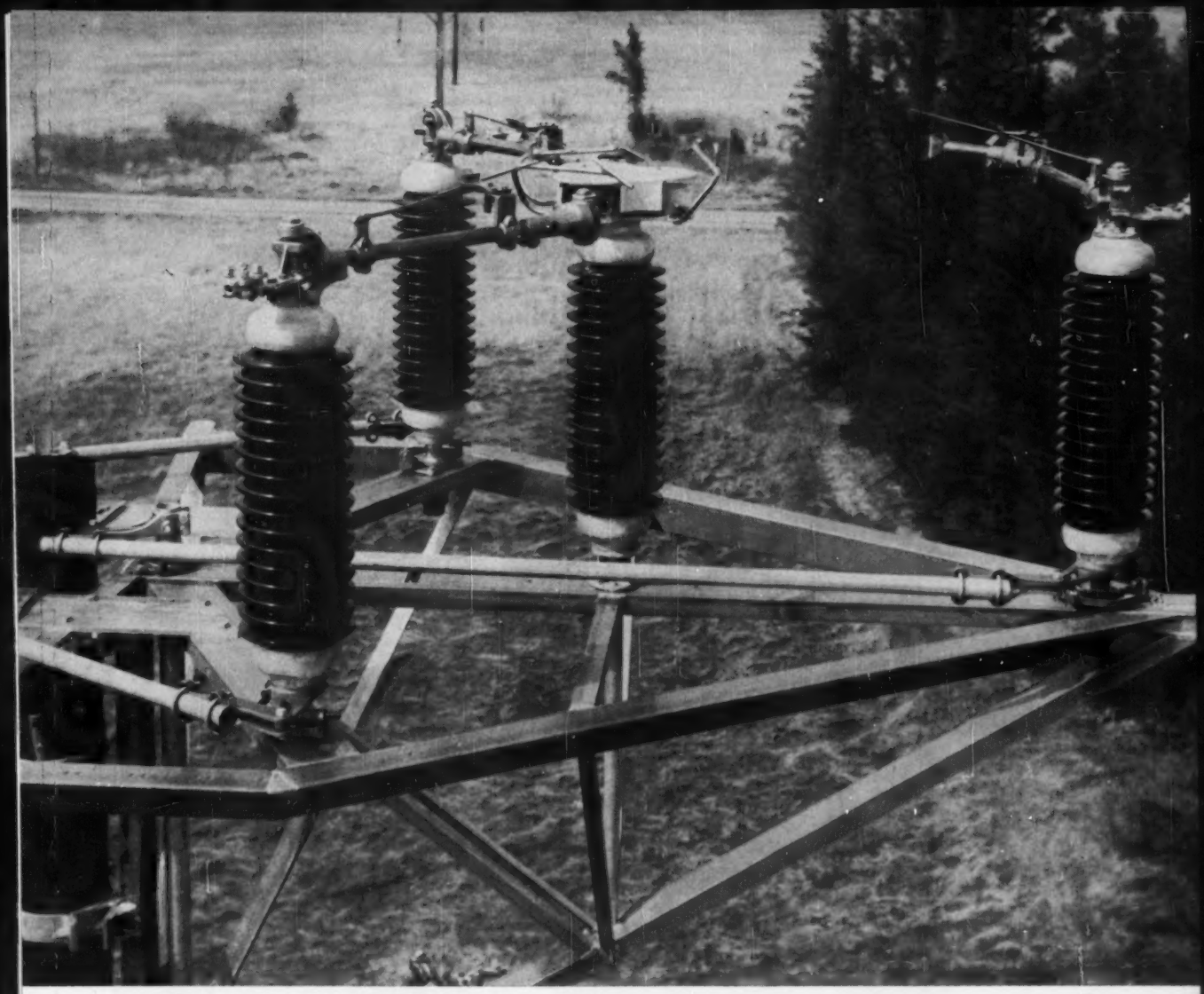
There are many outstanding mechanical and operating features of Southern States Pole-Pak phase-over-phase air switches. But the speed and ease of installation are particularly outstanding advantages.

Southern States employs an exclusive, simplified mounting system. Clamp-type steel bands are fastened to the pole at pre-determined positions. No gaining or drilling is necessary, assuring longer pole life. All switch units are assembled on the ground and hoisted into position. Hooks on the switch frame slip over a mounting plate on the top band, providing temporary suspension and automatically lining up mounting holes for quick and easy permanent bolting. It's that simple!

Other Pole-Pak Features

The Pole-Pak uses Southern States Type 57L braidless air switches. These rugged switches are equipped with Amplitact® contacts, time-proved as the most dependable means devised for handling high short currents.

The Southern States 57L switch is unusually easy to operate. Its blade is designed to toggle into the closed position and has no tendency to open. No force from the operating mechanism is needed to keep the switch closed. The switch is easily oper-



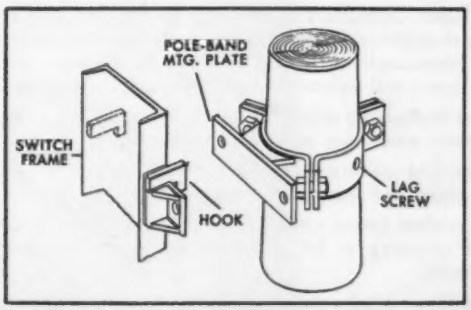
SOUTHERN STATES POLE-PAK is available in voltage ratings from 7.2 kv through 69 kv and continuous current ratings of 600 and 1200 amperes. One- two- or three-way models are available. Southern States Type 57L side-break braidless air switches with Amplitact® contacts are used in the Pole-Pak.

ated by one man, even under icing conditions.

The Pole-Pak frame is constructed of 6061-T6 structural aluminum with adequate bracing for vertical angular pulls in addition to line tensions.

This phase-over-phase method of switching, employing only one pole, with its many time-saving and cost-saving advantages, warrants careful consideration.

Get full information from your Southern States representative, or write for Bulletin 61 PP.



SIMPLIFIED MOUNTING results from exclusive system. Steel band is clamped to pole. Two lag screws prevent slipping. Hooks on switch frame slip over pole-band mounting plate. No drilling or gaining of pole is necessary.

SOUTHERN STATES
HAMPTON, GEORGIA

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THOMAS A.

EDISON

omniguard systems protect equipment, decrease downtime in generating plants

The Edison Omniguard system keeps constant watch on critical temperatures throughout electric generating plants. Omniguard monitors such vital temperatures as those of bearings on the main turbine generator, fluid drives, coal pulverizers, main feed pumps and other vital auxiliaries.

When overheating occurs the alarm sounds *before* damage occurs and corrective action may be taken immediately.

By guarding against overheating the equipment runs at optimum efficiency, lasts longer and requires less maintenance.

This modern Edison system is a simple, reliable means of keeping equipment operating at full efficiency and protecting against emergency shutdown.

For additional information on Edison Model 310 Omniguard temperature monitor and the wide variety of detectors available for use on all types of auxiliaries, pressure vessels, tanks and pipe lines, write for publication 3036C.

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INSTRUMENT DIVISION
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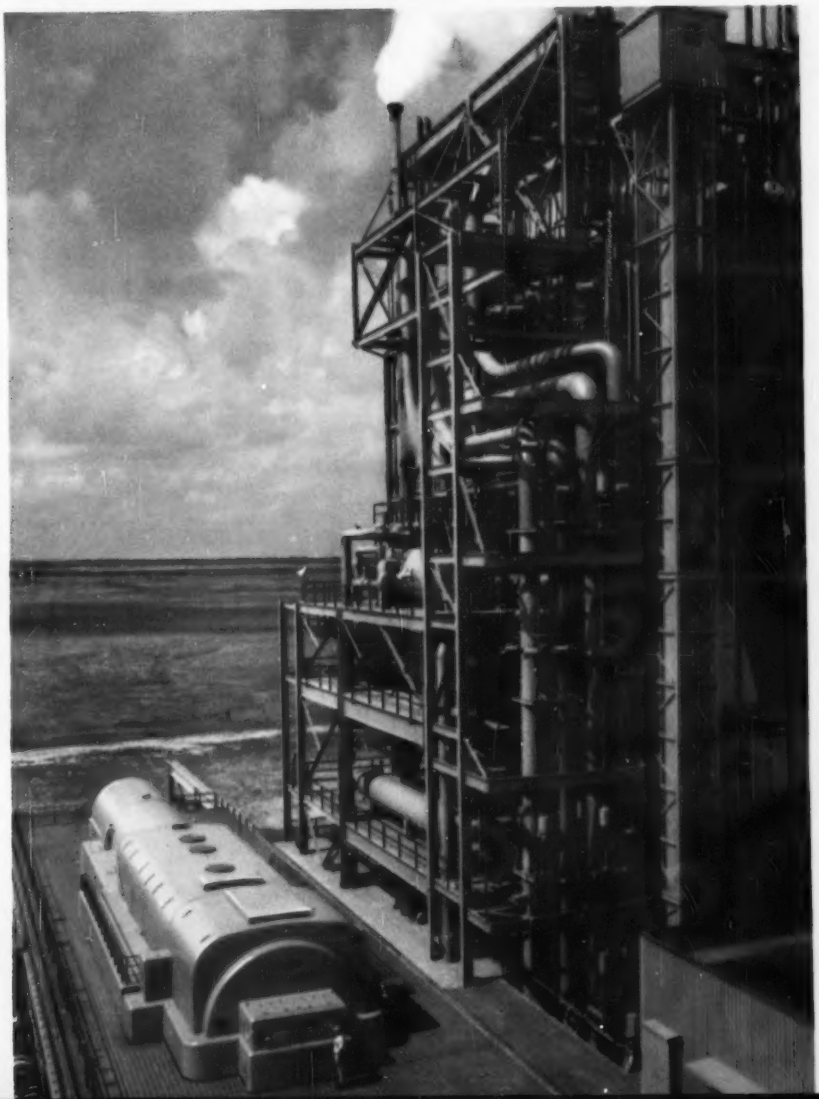
NEW

INSTALLATION TECHNIQUES MAKE ALL OTHERS OBSOLETE



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A-1492

Pre-installed piping systems and precision optical tooling cut man-hour expenditures as much as 34 percent

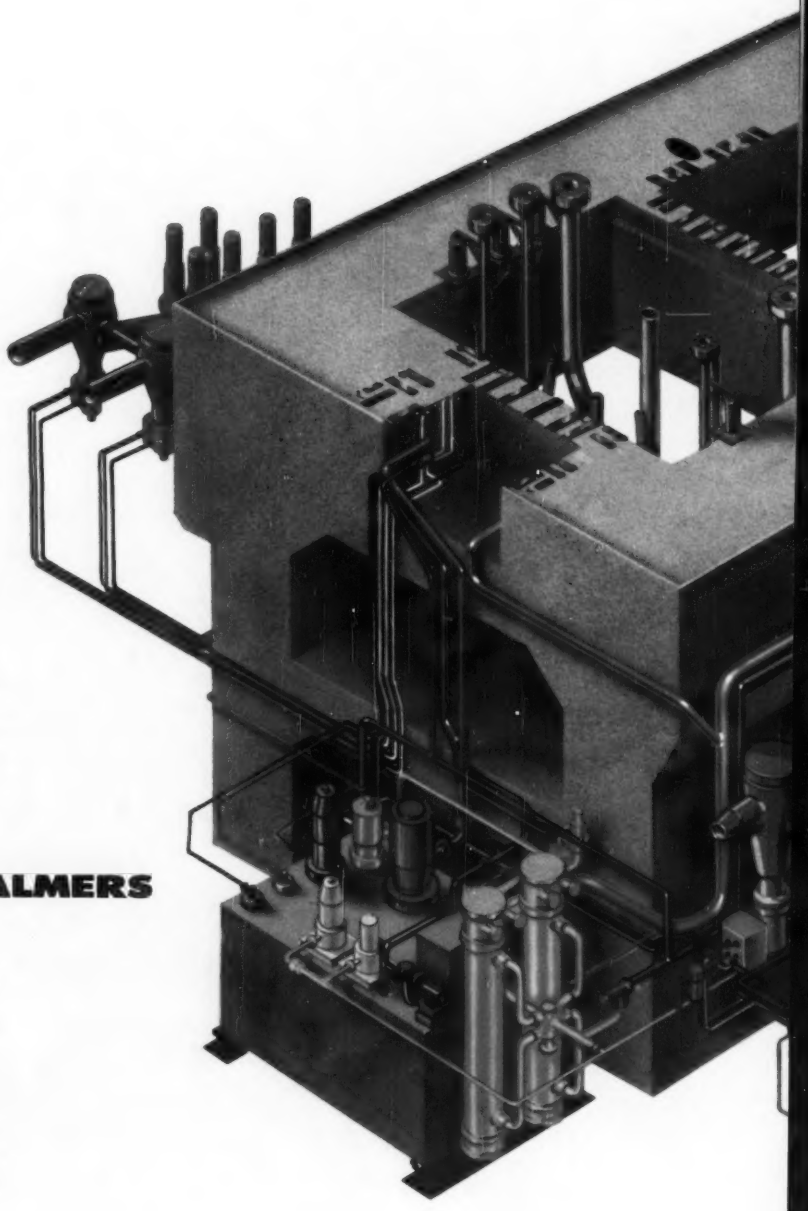
Exclusive A-C tools and techniques reduce turbine-generator installation costs — permit faster, ultra-accurate unit assembly — establish new power industry standards.

For example, a 220-mw tandem triple-flow unit (see bar chart) was recently installed in 25,000 man-hours with new A-C techniques — against 38,000 man-hours required with other methods. And this machine was placed on the line without a shutdown between first steam admission and attainment of maximum load — dramatic proof of the effectiveness of the advanced Allis-Chalmers methods. Equivalent results, unmatched in the industry, are being recorded with other large A-C units!

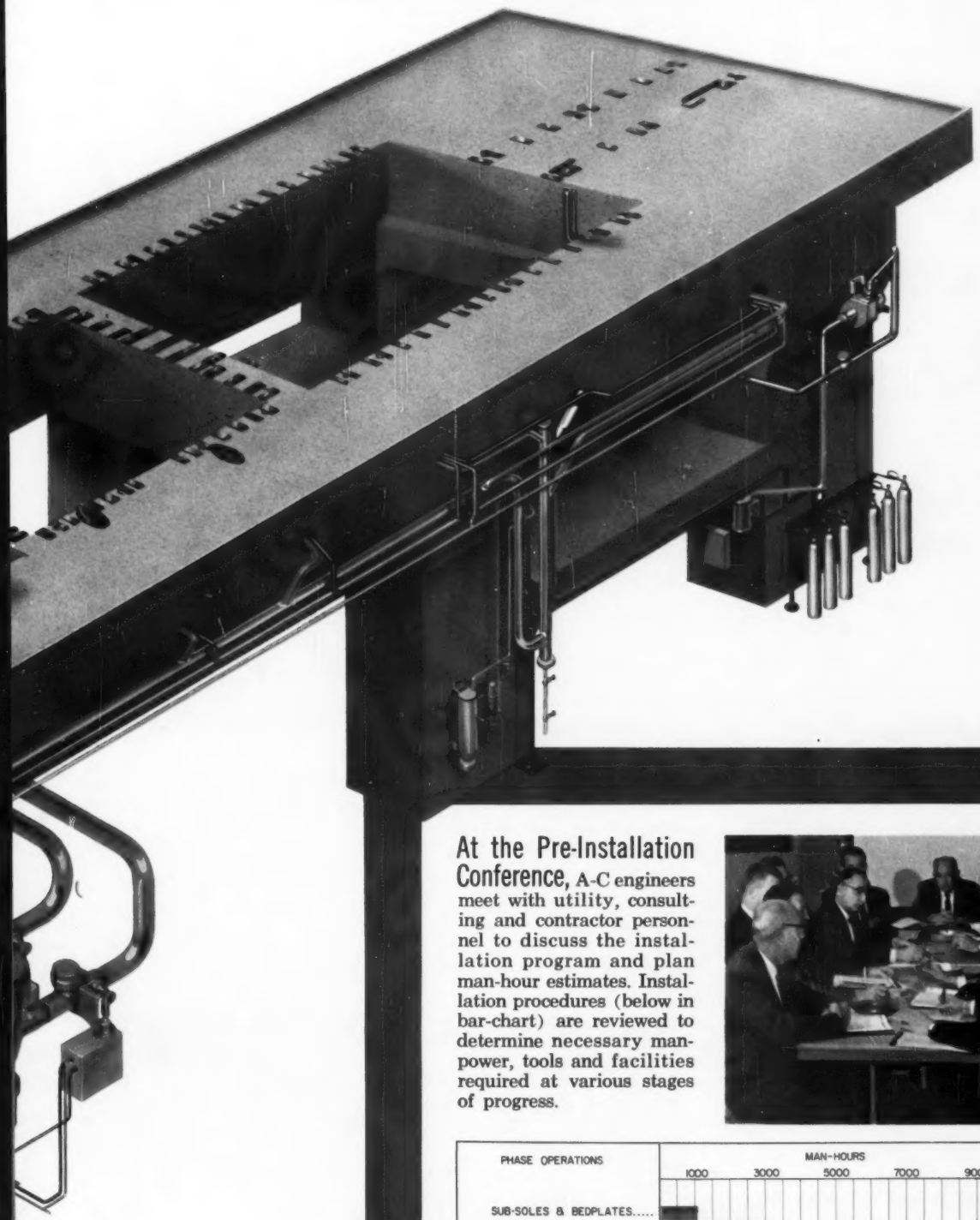
Factory-field coordination, based on modern turbine-generator assembly and testing facilities, translates components from test pit to foundation with absolute precision and man-hour reduction.

Advances such as these stem from Allis-Chalmers vast experience and forward-thinking engineering. They help electric utilities meet the economic and scientific challenges of tomorrow.

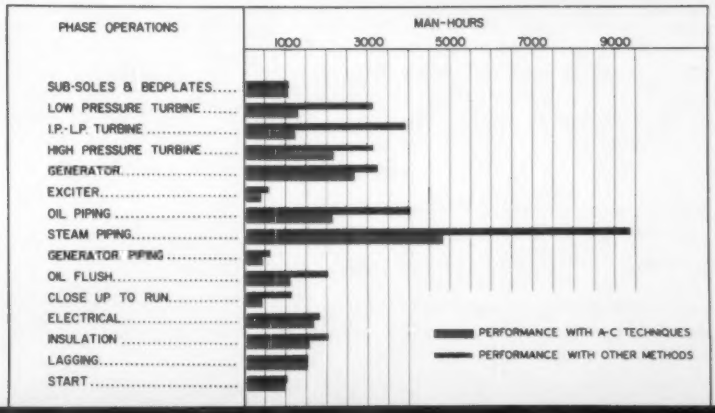
ALLIS-CHALMERS



Pre-Installation of All Below-Floor Pipe and Equipment is completed prior to placing of main unit components on foundation plates. This technique saves thousands of man-hours — assures highest degree of cleanliness and quality for piping and closure welds. Complete oil tank assembly and piping, steam chest, reheat valves and piping, generator coolant and scavenging piping systems are installed with better control . . . also, less interference because fewer men are present; the work area more accessible.



At the Pre-Installation Conference, A-C engineers meet with utility, consulting and contractor personnel to discuss the installation program and plan man-hour estimates. Installation procedures (below in bar-chart) are reviewed to determine necessary manpower, tools and facilities required at various stages of progress.



PROCEDURES COORDINATED BY UNIFIED SUPERVISION

minimize installation time . . . assure ultra-accuracy . . . simultaneously!

Installation Responsibility Under One Superintendent unifies job supervision — uniquely covers existing A-C equipment at the power station as well as new turbine-generator and additional A-C products. Central responsibility assures close control of installation procedures — permits prompt job-site decisions.

Special Centerline Telescope permits quick alignment of major turbine components. During manufacture this precision instrument determines final relative position for each pedestal bearing bore. At the job site, the telescope re-establishes this centerline for accurate turbine assembly with all clearances as determined at the factory. Field measurement of internal clearances is eliminated and installation of components, including those shipped with spindles in position, is accomplished faster and more accurately.

☆ ☆ ☆

***For Bulletin 03B9997,** which gives you further information about Allis-Chalmers advanced installation techniques, ask your nearby A-C office or write Allis-Chalmers, Power Equipment Division, Milwaukee 1, Wis.*

With Precision Optical Leveling Equipment, field installation of Allis-Chalmers turbine-generator units is little more than a reassembly operation. Savings to you . . . over 8,000 man-hours for a tandem triple-flow machine; similar reductions for other types and ratings. This special tooling permits simultaneous establishment of horizontal reference planes on the test pit (top) and on the foundation (bottom). All factory-recorded clearance and reference data plus assembly shim packs are translated from level plane to level plane. *Result: precise unit alignment and assembly with no time-consuming "cut and try" operations or delaying field adjustments.*

ALLIS-CHALMERS PACING POWER PROGRESS

Electrical World

JULY 10, 1961
Vol. 156, No. 2

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NEXT WEEK

STREAMLINED 115-KV LINE is built on city streets. Also, EW covers AIEE summer meeting.

The Electrical Week

LATE NEWS ▸

Lawrence J. O'Connor, 46, is nominated to the FPC by President Kennedy to succeed Arthur Kline, whose term has expired. O'Connor is a Democrat and Kline a Republican, and Democrats will have a three-to-two majority if O'Connor is confirmed. The nominee is presently oil imports administrator for Interior Department.

A record-breaking amount of testimony delays probable action on the Public Works Appropriation Bill for fiscal 1962 until end of this month; about one month longer than anticipated. It is in the hands of the House Appropriations Committee. The Senate Appropriations Committee still plans to await a final House bill before it holds hearings on controversial reclamation projects, including Upper Colorado transmission lines and Trinity project transmission.

Five communist officers of Britain's Electrical Trades Union are found guilty of election rigging, and a new general secretary will be named. Though only about 1% of union members are communists, at least eight officers are party members elected through rigged elections. Probable new general secretary is John Byrne, who was defeated in the rigged election.

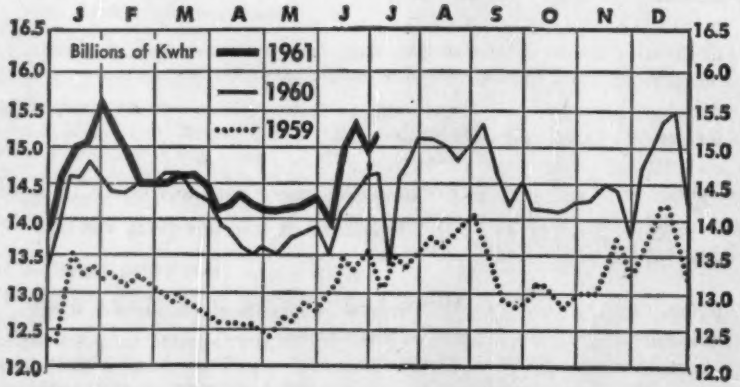
Portland, Ore., strike of hoisting and portable engineers Local 701 shuts down work on huge John Day project of the Corps of Engineers. Negotiations have been going on since Mar. 13—contract expired Mar. 31.

Cloverdale and Kanawha River steam electric generating stations of Appalachian Power Co will be tied together with some 122 miles of 345-kv transmission line. The line will strengthen the eastern perimeter of Appalachian and its parent co, American Electric Power Co. Collier Construction Co will build the line; New England Tree Expert will do right-of-way work. Project will take two years.

Sierra Pacific Power Co plans to build a 75-Mw reactor between 1965 and 1970 to serve Reno area. Disclosure was made at two-day forum held by Fact-Finding Committee on Nuclear Energy for the State of Nevada. State officials may encourage more A-plants because of high fossil fuel cost.

New Jersey Supreme Court upholds right of Public Service E&G to build a power line along a railroad right-of-way at Roselle near Newark. The state PUC had ruled in favor of the company after the borough of Roselle objected to the line and then amended a city ordinance to prevent erection of overhead lines of more than 33-kv capacity. This would have forced Public Service to put the line underground. Work started in 1956 but has been held up because of the dispute.

WEEKLY POWER OUTPUT—Up 3.7% (Week ending July 1), Kwhr 15,183,000,000



Percent Change From Previous Year

	June 17	June 24	July 1
Total U. S.	+ 6.3	+ 1.8	+ 3.7
New Eng.	+ 6.8	+ 7.2	+ 4.6
Mid. Atlan. ...	+ 8.0	+ 4.3	+ 2.4
Cent. Indust...	+ 5.9	+ 2.0	+ 5.2
West Cent.....	+10.4	+ 2.6	+ 7.7
Southeast	+ 6.2	+ 0.6	+ 1.2
South Cent....	+ 2.4	−14.1	− 4.4
Rocky Mount...	+ 7.6	+11.1	+10.9
Pacific			
NW	+ 2.1	+ 3.2	+ 5.2
SW	+ 7.8	+10.9	+ 9.8

Seasonally Adjusted Index 285

Week Ago 279 Year Ago 275

Source: Edison Electric Institute

Supply Lines

IDENTICAL PRICING CONTROVERSY SPREADS TO CANADA

The controversy over identical pricing in the electrical industry has spread to north of the border. The Canadian government is now looking into identical or near-identical bids on equipment for utilities and municipalities to see if a violation of antitrust laws is involved. And the president of the Canadian Electrical Manufacturers Assn is saying that "similar prices are, in most cases, arrived at by evolution rather than collusion."

Speaking at the recent annual meeting of the Canadian Electrical Assn, CEMA President J. W. Kerr explained the manufacturers' views of this evolutionary process to the utility executives. "We have moved from a manual manufacturing economy into a machine manufacturing economy in order to produce more efficiently and effectively. Unfortunately, in moving into this machine economy, we vastly increased our fixed and irrevocable costs—costs which are there day to day whether our plants are operating or not . . . Since we are operating in a machine economy there is competitive influence on the market place—in a period of low demand and low prices, all competitors recognize that their volume is insufficient to absorb their fixed overhead costs.

"If we operated in a monopolistic atmosphere, an increase in prices would immediately correct this situation—but we don't—so instinctive action is to increase share of the market by marginal selling price reductions, which merely sets up chain reactions, further aggravating price levels which bear no relation to cost and profit objectives. In addition, this deteriorates relationships between manufacturer and customer, because the customer looks at these new low prices in comparison with previous price levels which he now views with suspicion as being unjustifiably high. Some are even encouraged to adopt tactics which provoke price wars.

"Ultimately, the manufacturers with the slenderest resources and narrowest product diversification may be forced out of business, despite the fact that they may be the most efficient producers! With these downward pressures so strong and with many of the electrical products made to standard engineering design, you can readily appreciate the reluctance to deviate from printed and established price levels . . ."

GOVERNMENT CLARIFIES 'UNREASONABLY LOW' PRICES

The Justice Department has clarified a little further what it means by "unreasonably low" prices, the phrase which is a stumbling block in the way of getting General Electric Co to sign consent decrees in the civil antitrust cases (EW, June 26, p 15). The clarification has come via an unrelated case before the US Supreme Court.

Two factors make prices unreasonably low, according to the government's view: sales below cost and the purpose of destroying competition or eliminating a competitor. These factors follow the wording of Section 3 of the Robinson-Patman Act from which the "unreasonably low" price clause was taken. Observes a Justice Department attorney, "We never have proposed to go farther than that."

As it happens, a federal judge in Missouri ruled that Section 3 of the act was so "vague, indefinite and uncertain" that it was unconstitutional. And it is this ruling, in a complaint that National Dairy Products Corp was allegedly attempting to drive competitors out of business by using predatory prices, that the govern-

ment is appealing to the Supreme Court. National was charged by the Justice Department with using advantages of size to "finance and subsidize a price war against small dairies selling milk in competition with it . . . by intentionally selling milk at prices below National's cost." It is such a practice, apparently, that the Justice Department is attempting to forestall in the electrical business.

Not all prices below cost are illegal, the government acknowledges. There are situations where below-cost sales may have a "legitimate commercial objective" —such as disposal of excess inventory or obsolete merchandise. But besides that, the government points out that "predatory intent" to injure competition is a necessary element in establishing whether a price is illegally low.

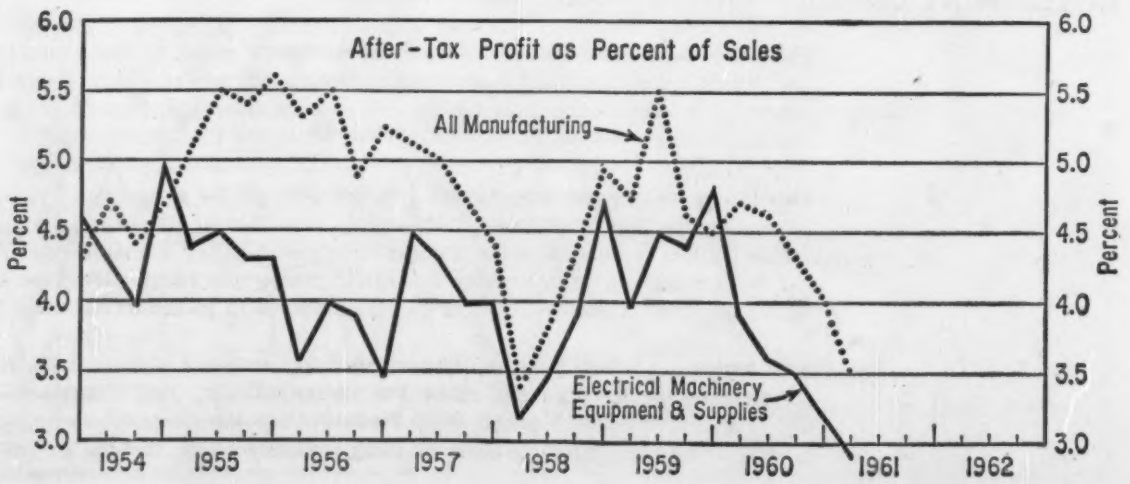
TAMPA ELECTRIC MAY ASK $10 MILLION IN DAMAGES IN COAL CASE

Tampa Electric Co attorneys have indicated the company may file an amendment asking for more than $10 million in damages in a federal suit over a coal contract pending settlement in Nashville, Tenn. Tampa Electric has already asked for $3,750,624 for damages accrued between Sept. 1, 1958, and March 31 of this year, for alleged breach of the 1955 contract. Now, Tampa attorneys say, a flat sum of more than $10 million may be asked to cover all damages.

The breach of the 1955 contract, between Tampa Electric and Nashville Coal Co, occurred after Nashville Coal was bought by West Kentucky Coal Co. West Kentucky said the contract, which would have provided all the coal for a new generating station for Tampa for 20 years, was illegal under the Clayton Antitrust Act, and therefore it refused to supply the coal. Tampa disagreed and filed suit. After three years of litigation, the US Supreme Court last March ruled that the contract did not violate the antitrust laws (EW, Mar. 13, p 22) and remanded the case to the district court for assessment of damages. The federal judge in Nashville has now scheduled a hearing for October to go into this matter of damages.

SUPPLIERS' PROFITS SLIP AGAIN

Electrical manufacturers' profits dipped again during the first quarter, to 2.9% of sales, while all manufacturing dropped to 3.5%, the Securities & Exchange Commission and Federal Trade Commission report:



Ray Rowe, Product Manager, Protective Equipment and Capacitors, exhibits first production sample of the new economy type EDO fuse cutout. Built to meet the demand for low price, it offers many desirable features. Ask the L-M Field Engineer to show you a sample.

New $16 L-M Open Type EDO Fuse Cutout Meets Need For Economy, Performance

To fill the requests of many operating companies for an economically priced, medium duty, open type cutout, L-M offers the Type EDO. Designed for savings plus performance, the EDO can be used with complete assurance where high fault capacity is unnecessary. Although maximum interrupting capacity is below present NEMA standards, the EDO has been tested and proved over the range of operations for which it has been designed.

The EDO has many desirable features, developed through L-M's many years of experience as a leader in fuse cutouts. The unit is small, compact. Fuse tube closes fully from any angle. Takes any standard button-head link. Fully bird-proof. Non-ferrous current-carrying parts. Rated at 100 amperes. The 7.8 kv unit costs as little as $16; the 15 kv is as low as $18. Available with link-break attachment if desired.

RATINGS AND INTERRUPTING CAPACITIES

Voltage Rating —KV	Current Rating— Amperes	Interrupting Capacity— Amperes	Minimum 60 Cycle 1 Minute Dry Withstand Voltage —KV RMS*	Minimum 60 Cycle 10 Second Wet Withstand Voltage	Impulse Withstand Voltage on 1½ x 40 Microsecond Wave—KV*
7.8	100	3000	27	24	75
15	100	2000	35	30	95

*In accordance with "NEMA Standards For High Voltage Fuses," Section SG2-3.18.

Get complete information on fuse cutouts

L-M offers a complete line of protective equipment, including a variety of both open and closed cutouts. Ask the L-M Field Engineer for information from L-M's extensive file on system protection. Or write Line Material Industries, Milwaukee 1, Wisconsin. In Canada: CLM Industries, McGraw-Edison (Canada) Limited, Toronto 13, Canada.

513

LINE MATERIAL® Industries
McGRAW-EDISON CO. *Protective Equipment*

DISTRIBUTION TRANSFORMERS • RECLOSERS, SECTIONALIZERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS • LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT
PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS • OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE & CONDUIT

Residential installation of L-M Pad-Mount Transformer, showing locations of primary and secondary runs. L-M Permaline conduit permits pulling cable whenever necessary without destroying costly landscaping and driveway pavements.

Cut Long-Range Costs Of Underground With Cable In L-M Permaline Conduit

Direct burial fibre conduit makes it easy to replace cable for faults or load growth without costly damage to customer's shrubbery and driveways.

by **W. M. BLOOM**
Product Manager, Fibre Products
Line Material Industries

Long a leader in equipment for underground distribution, Line Material recognizes the cost problem for utilities. L-M has made many contributions toward cost cutting by originating the Pad-Mount transformer; with L-M Transclosures and Power Pedestals; and with a completely engineered system for fibre conduit.

While unprotected cable offers attractive savings in original cost of an underground installation, long-range cost can be substantial, when cable must be dug up because of failures, or replacements for load growth. Replacement of shrubbery and driveways can be costly; loss of customer good will is inestimable.

Cable in Permaline direct burial conduit can be pulled and replaced easily, economically. Ask the L-M Field Engineer for information and bulletins on L-M Permaline Conduit and underground distribution equipment; or write Line Material Industries, Milwaukee 1, Wis.

Long lengths, light weight, make L-M Permaline Fibre Conduit easy and economical to install. Available in 2-4" sizes, in 5, 8, and 10-foot lengths. Complete stocks at L-M Distributors and L-M's strategically located warehouses.

LINE MATERIAL® Industries

McGRAW-EDISON COMPANY

4988

Permaline Fibre Conduit

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DISTRIBUTION TRANSFORMERS • RECLOSERS, SECTIONALIZERS AND OIL SWITCHES • FUSE CUTOUTS AND FUSE LINKS
LIGHTNING ARRESTERS • POWER SWITCHING EQUIPMENT • PACKAGED SUBSTATIONS • CAPACITORS • REGULATORS
OUTDOOR LIGHTING • LINE CONSTRUCTION MATERIALS • PORCELAIN INSULATORS • FIBRE PIPE AND CONDUIT

LINE MATERIAL FINDS "A BETTER WAY"

Close-up of Peltier thermoelectric device. Spring tension on the heat pumps automatically adjusts the device to different lamp bulb diameters. Can be used with any T12 through T17 lamp. L-M's Peltier device is presently available only for 6-foot, 4-lamp shallow luminaires.

This six-foot, four-lamp shallow luminaire utilizes four L-M Peltier thermoelectric heat pumps for spot-cooling the fluorescent lamps. In the heat pump, direct current flows through a series of junctions of dissimilar metals, alternately absorbing heat in one junction and liberating heat in the other. The cold junctions contact approximately one-half square inch on the lamp bulb walls thereby maintaining the mercury vapor pressure within the lamps at the optimum value for maximum light output.

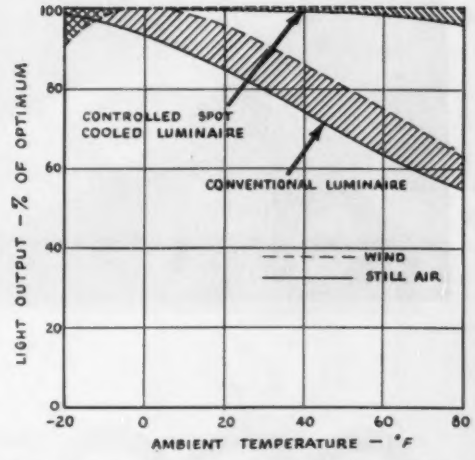
L-M's Revolutionary New Development Keeps Fluorescent Output at Maximum

by **STACY STANDLEY,**
Product Manager, Lighting
Line Material Industries

Now—Line Material develops another important engineering advance in outdoor lighting—Thermoelectrically Cooled Fluorescent Luminaires. These luminaires solve the basic problem of fluorescent lamp lumen output variation caused by ambient temperature changes. Another vital contribution by Line Material Industries to better outdoor lighting.

L-M Lighting Development Engineers have ingeniously adapted the Peltier thermoelectric principle to spot-cool fluorescent lamps. By the simple process of cooling a small area of each lamp, internal mercury pressure is held at the optimum and light output is maximized regardless of ambient temperature.

Be sure you get complete information on L-M's latest contribution. Contact your L-M Lighting Engineer, or write direct to Line Material Industries, Outdoor Lighting, Milwaukee 1, Wisconsin. In Canada: CLM Industries, McGraw-Edison (Canada) Limited, Toronto 13, Canada.



Performance curves of luminaires with and without controlled spot cooling: solid edge of band represents still-air conditions, dotted line represents 10 MPH of wind.

LINE MATERIAL® Industries Outdoor Lighting
McGRAW-EDISON COMPANY

McGRAW EDISON

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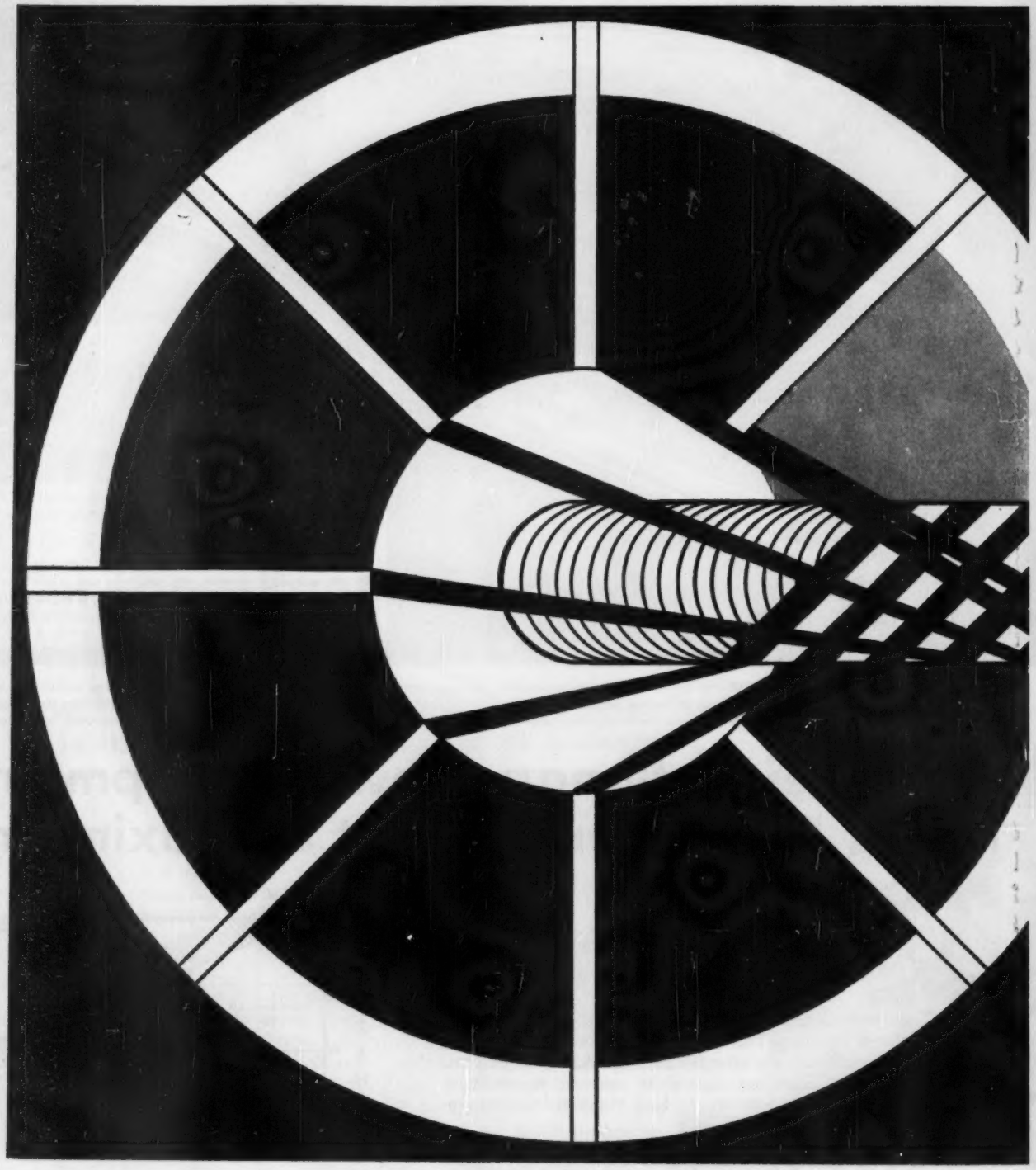

No group looks harder for improvements than utilities. That's why they have actually been able to maintain the unit price of electricity, in spite of continuing higher costs. ☐ There are ways to improve wire and cable, too, and General Cable is always alert for them. One example is a unique machine which tapes EHV cable continuously, in "white room" conditions. It's another way General Cable "does it better" in creating more reliable products for you. General Cable Corporation, 730 Third Avenue, New York 17, N.Y.

GCC
GENERAL CABLE CORPORATION

Beefed up for hardest

Onan builds every plant as if a life depended on it. We never know the ultimate use of an Onan generator when it comes off the line, but before the Performance Certified tag is attached, we *do know* the plant could be depended upon in *any* emergency. Whether your need is for emergency lighting or electricity for an iron lung, why settle for second best? Before you buy any electric plant, see your local Onan distributor or dealer.

Stellite coated exhaust valves and valve seats. One of toughest alloys known. Gives you up to 300% longer valve life than uncoated valves. It's the important details like this that make Onan more economical in the long run.

Exacting standards govern manufacture—years of specialized experience and extensive testing facilities control the quality of Onan Power Plants. Over 1000 different types and sizes of plants are produced by Onan.

use...even abuse

Onan electric plant still delivers full power after 12,197 hour test—equal to 487,888 miles

A grueling endurance test that lasted one year, nine months and 12 days could not stop Onan test plant #1068. Onan engineers used this production-built unit for an endurance run—and after it was all over, it still generated the full rated power promised on the nameplate. Proof that Onan's exacting standards and production testing give you a power plant with long, dependable life built in.

Over 1,700 other endurance units have been run by Onan engineers. In these tests every design feature and part has to prove itself before it can become a part of the Onan you buy. In addition, every type and size Onan plant is tested under all operating conditions which could conceivably affect performance on your job.

Hours of running in and testing under full load are given *every* Onan before it is shipped. An independent testing laboratory then spot tests Onan Plants that have already been tested by Onan—double assurance that every Onan will deliver its full nameplate rating. Only then does an Onan production run qualify for Performance Certification.

Buy *proven performance* when you buy an Electric Plant. See your authorized Onan distributor or dealer. You can depend on him for a lifetime of factory parts and service. He's listed in the Yellow Pages.

ONLY ONAN GIVES YOU THIS CERTIFICATION

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Onan
PERFORMANCE CERTIFIED
We certify that when properly installed and operated this Onan electric plant will deliver the full power and the voltage and frequency regulation promised by its nameplate and published specifications. This plant has undergone several hours of running-in and testing under realistic load conditions, in accordance with procedures certified by an independent testing laboratory.

World's Leading Builder of Electric Power Plants

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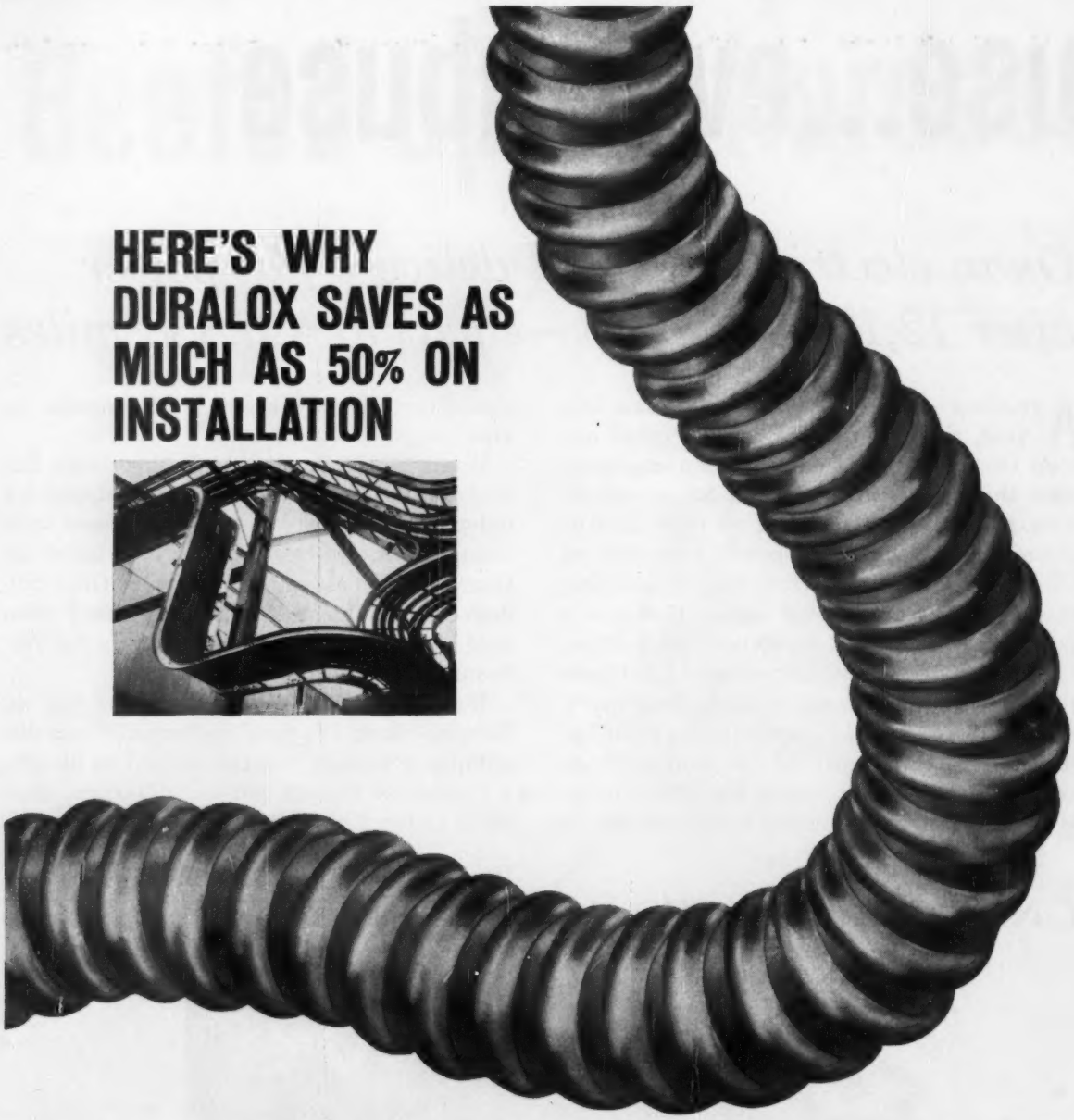
HERE'S WHY DURALOX SAVES AS MUCH AS 50% ON INSTALLATION



You save time . . . you save money . . . you save manpower —with Anaconda butyl-insulated Duralox.* *For Duralox has its own conduit of durable, yet flexible, metallic armor.*

This means fast and easy installation in long runs over and around obstructions, in trays, indoors or out—and all without the expense, trouble and time of laying rigid conduit and pulling cable through it.

Duralox will fit into your long-range plans as well—because it's 100% salvageable and can be readily moved as your plant layout changes.

Duralox's lower reactance—because of the close spacing of the conductors—results in reduced voltage drop and more efficient power distribution. Available in ratings of 5 kv, 15 kv, and higher, in addition to lower voltage ratings.

Whether your problem is wiring a new plant or rewiring an old one—see the Man from Anaconda. Duralox is just one of the many types of Anaconda wire and cable that can help you increase plant flexibility . . . reduce operating costs . . . bring in new power for your needs today and tomorrow. For full information on Anaconda Duralox Cable write for Bulletin DM-5606 to: Anaconda Wire & Cable Company, 25 Broadway, New York 4, New York.

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*Reg. U.S. Pat. Off. 61261

Duralox has Anaconda Butyl (AB) rubber insulation
for • extra-high resistance against ozone
• exceptional moisture resistance
• 22% more current-carrying capacity
than 70° centigrade insulation

SEE THE MAN FROM
ANACONDA®
FOR BUTYL-INSULATED
DURALOX POWER CABLE

UNI/DYNE TURRET™ giant in strength, compact in size, exclusive with PITMAN

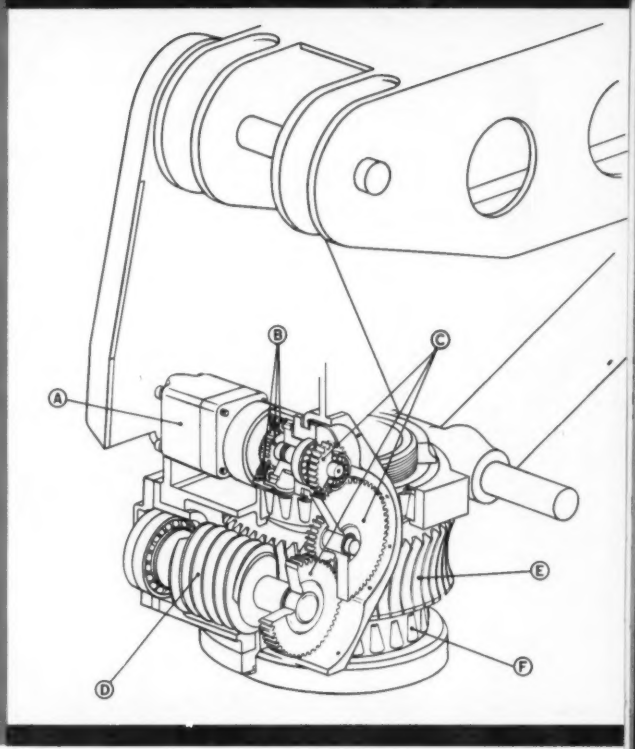
Now—out of the same dynamic atmosphere which produced the famous Pitman Polecat—comes an utterly new concept in creative engineering . . . the Uni/Dyne Turret, now provided as standard equipment on all Polecat models.

Pitman engineered the Uni/Dyne Turret to meet the ever-increasing list of job requirements for lifting and digging equipment and to provide the industry's standard for years to come. For the first time, a rotation system has been designed specifically for the job to be done. It obsoletes all competitive equipment.

Uni/Dyne Turret is extremely compact, enables Polecat unit to be mounted virtually *anywhere* on a utility line truck—new or in-use. Rotation gear system and hydraulic motor to run it are completely contained within the turret—there are no chains, sprockets, exposed gears, cables, or other compromises. Rotation locks instantly when power is removed, provides rigid base of operations.

Pitman Polecats, with exclusive Uni/Dyne Turret, are available in center-mount, corner-mount and top-mount models, and new top-mount model with operator seat. Turn this page for details.

TM



Note the clean, uncluttered design of Pitman's Uni/Dyne Turret! There are no exposed hydraulic hoses to snag. The turret-housing is a stress-relieved steel casting, which provides additional metal at points of strain. With all of its strength, Uni/Dyne is more compact than other turrets on the market; it installs even on a corner-mount, which requires only 14" of space. Its maximum over-all height is only 32". Uni/Dyne rotates 375° in either direction. Entire rotation system is enclosed, and operates in a bath of oil.

Hydraulic motor (A) operates planetary gear system (B), driving spur gear train (C), which turns worm (D) around main worm gear (E), providing rotation of entire unit. Tapered roller bearings (F) provide maximum load-carrying capabilities. Worm and worm gear lock instantly in case of power loss, preventing any boom rotation until power is re-applied; this self-locking rotation mechanism provides a rigid base for digging under tough conditions . . . lifting heavy loads precisely . . . raising men and tools aloft.

NOW, ALL POLECAT™ MODELS FEATURE

UNI/DYNE TURRET™ BY PITMAN

. . . leader in development of new hydraulic lifting and digging equipment

Uni/Dyne is standard equipment on all corner-mount, center-mount and top-mount Pitman Polecats. If you'd like to see one, your Pitman Utility Dealer will be glad to oblige with a thorough demonstration. Or, simply contact . . .

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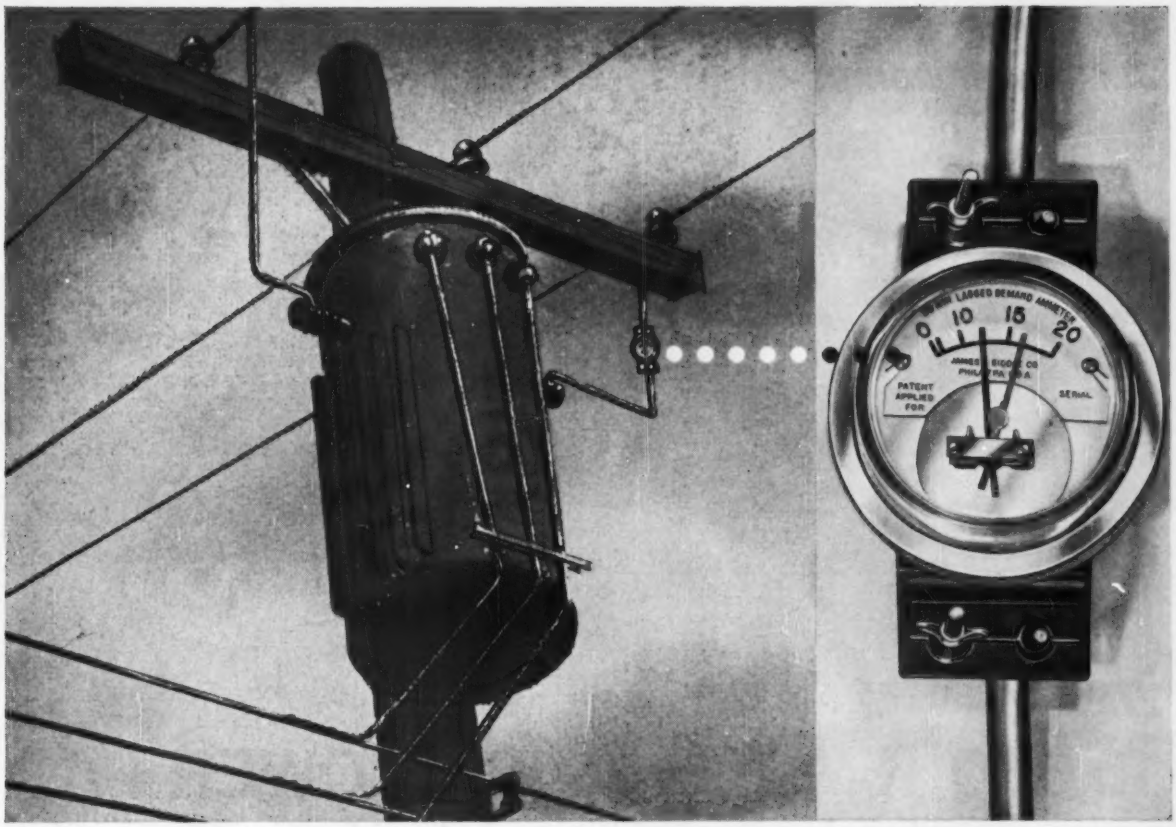
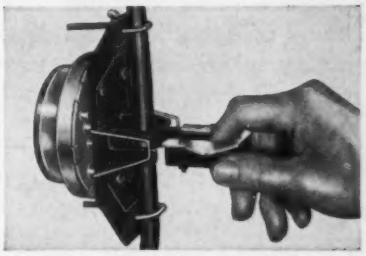


The BIDDLE LOAD INDICATOR

...provides a practical means for determining distribution transformer loading



. . . makes system monitoring economically sound through—low unit cost—minimum installation time and labor—no electrical connections or disconnections—no tools required.

Install Biddle Load Indicators for the life of your distribution transformers—they're rugged and completely conditioned for all weather and climates—and they are reliable in their performance.

The Biddle Load Indicator is, very simply, a demand ammeter with a 30-minute lag for indicating peak load. *It indicates the magnitude of the load,* not just a signal of a predetermined overload.

A red, maximum reset pointer indicates maximum value obtained since previous reset and is reset simply by passing a magnet across the face of the glass scale cover.

The black indicating pointer follows current changes, indicating the preceding 30-minute load continuously.

The Biddle Load Indicator will provide more of the nature and magnitude of actual transformer loads than has been obtainable before except by costly and prohibitively time-consuming methods.

Complete system load-monitoring is possible and economically sound with this simple but reliably accurate instrument.

For complete details write for Bulletin 50W.

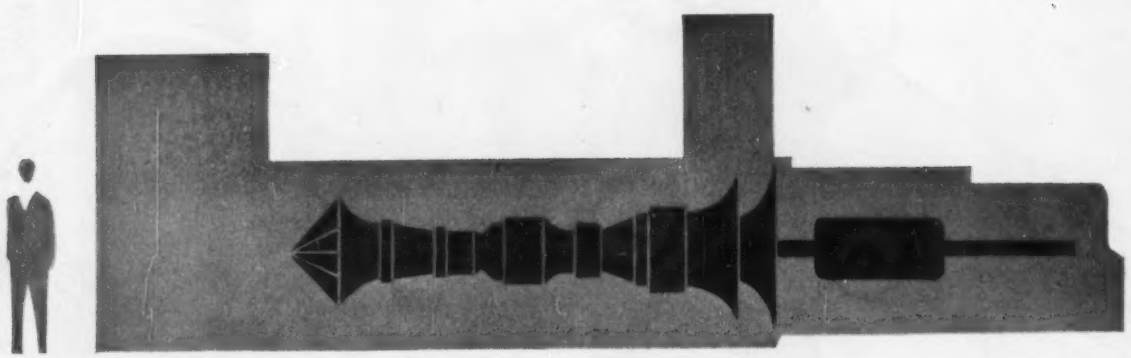
B112

BIDDLE INSTRUMENTS

JAMES G. BIDDLE CO.

Electrical and Speed Measuring Instruments / 1316 ARCH ST., PHILADELPHIA 7, PA.

Jet power comes down to earth



Pratt & Whitney Aircraft's new

10,000 KW TURBOJET POWER PAC

for economical peaking, end-of-line and stand-by power generation

The heart of this complete, packaged electrical power plant is the Pratt & Whitney Aircraft axial flow turbojet engine. Back of it are 13 years of engineering development. With over 20,000 units produced, its record of performance, reliability and durability has been proved in over 15,000,000 hours of operation. This dependability makes the Pratt & Whitney Aircraft industrial gas turbine ideally suited for remote, unattended power installations. And its simplicity of operation reduces costs all along the line.

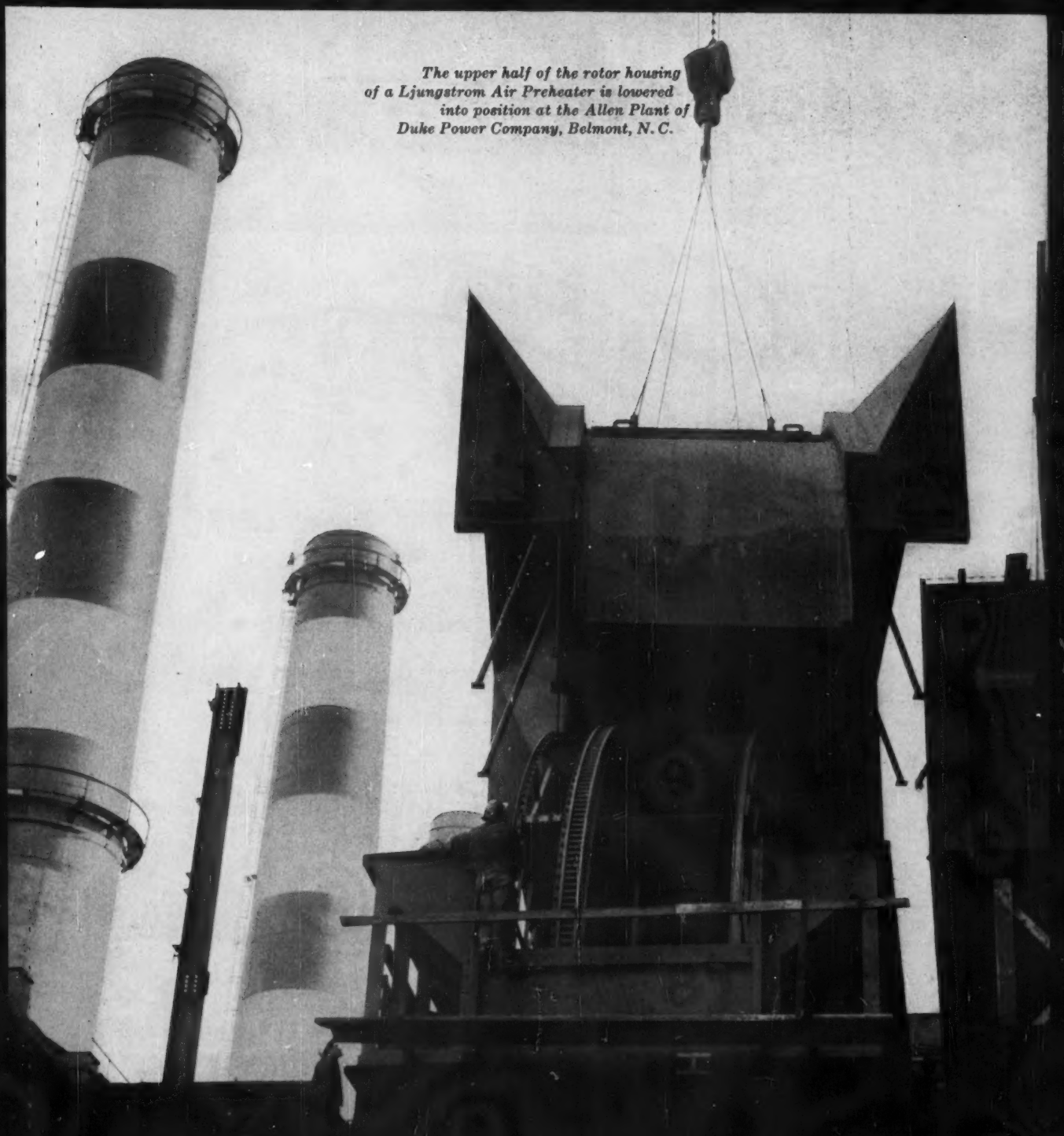
LOW INSTALLED COST—Easily transported, lightweight unit installed as complete package. No building required. Minimum site area for compact 20′ x 60′ size. Needs no heavy supporting structures, platforms, regenerators, or engine cooling system.

ECONOMICAL OPERATION—25% thermal efficiency without regeneration demonstrated in actual operation. Uses natural gas or light distillate fuels. Push-button operation, no manual attendance. On the line in two minutes—no warm-up or cool-down.

SIMPLE MAINTENANCE—Factory overhaul eliminates cost of maintenance personnel, shop, equipment and parts. Turbine can be replaced in less than six hours. Pratt & Whitney Aircraft's world-wide service is quickly available.

A representative of Pratt & Whitney Aircraft's Industrial Power Department will be glad to discuss the application of the Turbojet Power Pac to your individual requirements—at your convenience. Write:

Industrial Power Department
Pratt & Whitney Aircraft
Division of **UNITED AIRCRAFT CORPORATION**
East Hartford 8, Connecticut



The upper half of the rotor housing of a Ljungstrom Air Preheater is lowered into position at the Allen Plant of Duke Power Company, Belmont, N.C.

IN NORTH CAROLINA...

DUKE POWER INSTALLS ITS 47th LJUNGSTROM®

Duke Power engineers expect 10% annual fuel cost savings with Ljungstrom Air Preheaters at Belmont. Two 512,000-lb Ljungstroms on the #5 boiler of the Allen Plant will preheat incoming air from 80°F to 575°F. Continuous rotary regeneration will recover approximately 390°F waste heat. Every 40° thus recovered cuts fuel requirements 1%.

Our engineers will be glad to recommend how Air Preheater equipment can improve your operating results on new or existing fuel fired units.

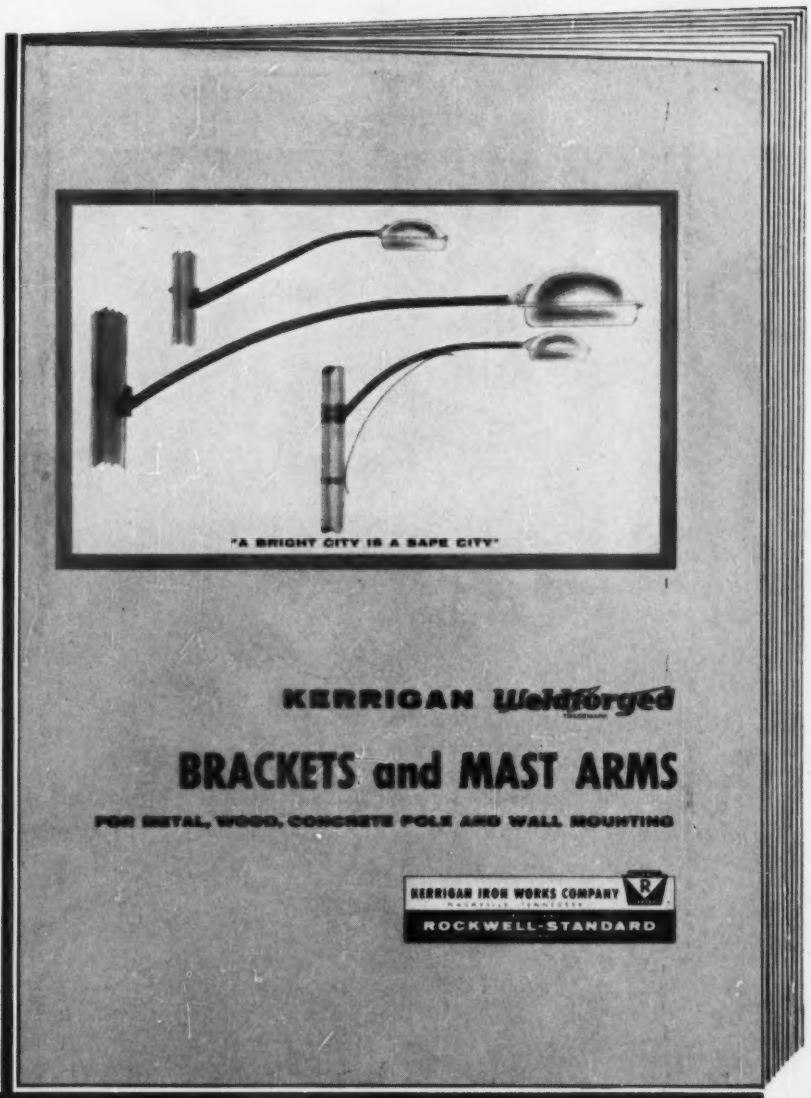
THE AIR PREHEATER CORPORATION

60 East 42nd Street, New York 17, N.Y.

NEW CATALOG

BRACKETS AND MAST ARMS

For Wood and Metal Pole Mounting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New catalog pictured here describes and illustrates (with full engineering data) a complete line of brackets and mast arms for wood, steel, aluminum pole and wall mounting. Choose from a variety of high-strength, attractive, modern supports and brighten up your city or town. Get YOUR copy NOW!

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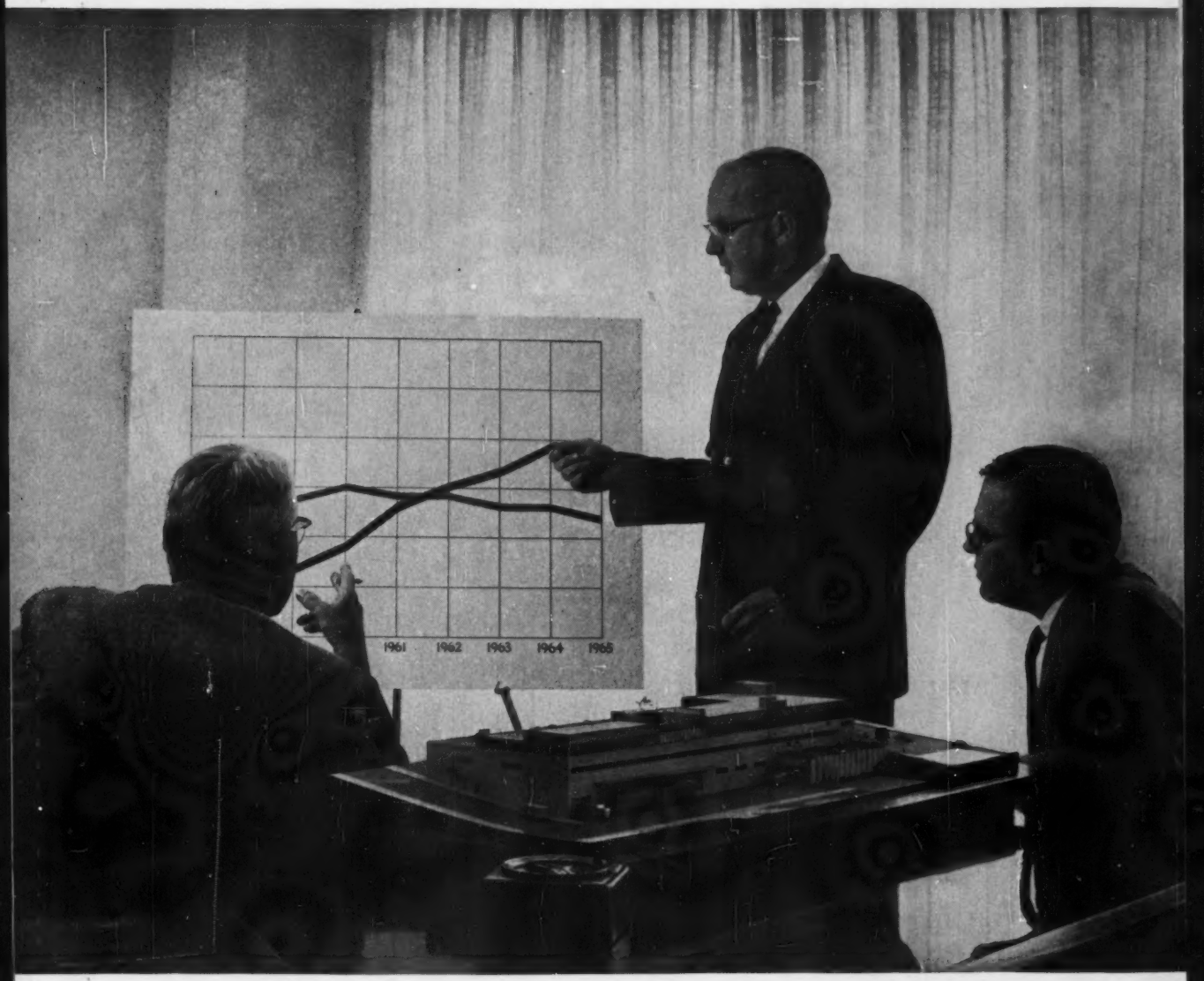
STREET AND AREA LIGHTING STANDARDS IN STEEL AND ALUMINUM

Pre-Engineering by **KAISER ENGINEERS** answers basic plant expansion questions...



Profitability? Faced with the decision to expand your plant facilities, you should first determine whether all elements combine to form a pattern of future profitability. Independent analysis of all aspects of your proposed program is the *Pre-Engineering* service offered by Kaiser Engineers. The studies and evaluations furnished by KE Pre-Engineering represent only one phase of total KE services. Kaiser Engineers designs and builds all types of power plants—steam-electric, gas turbine, combined cycle, nuclear and hydro-electric. From Pre-Engineering through design and construction, Kaiser Engineers provides complete one-company service and ingenuity based on years of experience.

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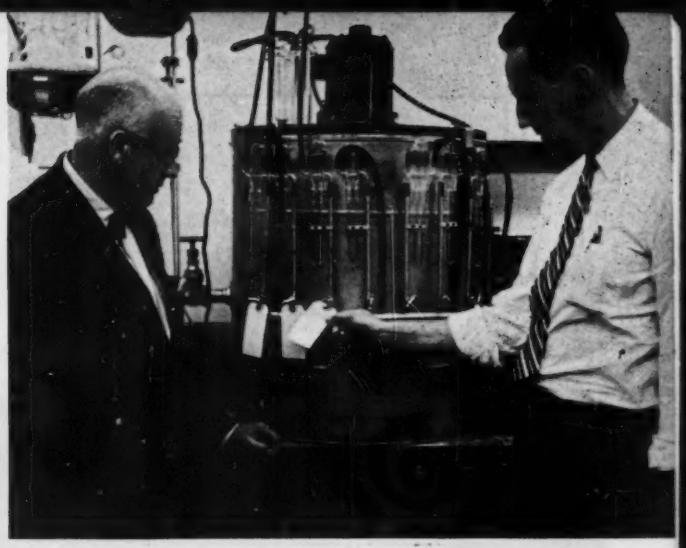
Analysis shows Gulfcrest® Oil close to original

Today, Philadelphia Electric operates nine generating stations that produce more than three million kilowatts. To keep the turbines operating at peak efficiency, chemists from Philadelphia Electric's chemical laboratory conduct tests on oils from all turbines every thousand hours for viscosity, neutralization number, interfacial tension, and color. From their records a pattern for unusually long service life for turbine oil is evident.

The most recent analysis for one turbine generator unit, put into operation in December, 1937, shows the turbine oil to be very near to its original specifications. Viscosity has increased just five seconds; the neutralization number has increased from 0.04 to 0.08 and the color has darkened only slightly. In addition, other units have run up to 175,000 hours and the test results on oil samples are remarkably the same.



T. C. Park, Jr., Gulf Sales Engineer, left, and chemist of Philadelphia Electric are shown here in the chemical laboratory.

Control panels are constantly monitored to assure dependable power service.

This 175,000 kw turbine was installed recently by Philadelphia Electric at its Schuylkill station. The turbine oil: Gulfcrest.

specifications after 24 years of service

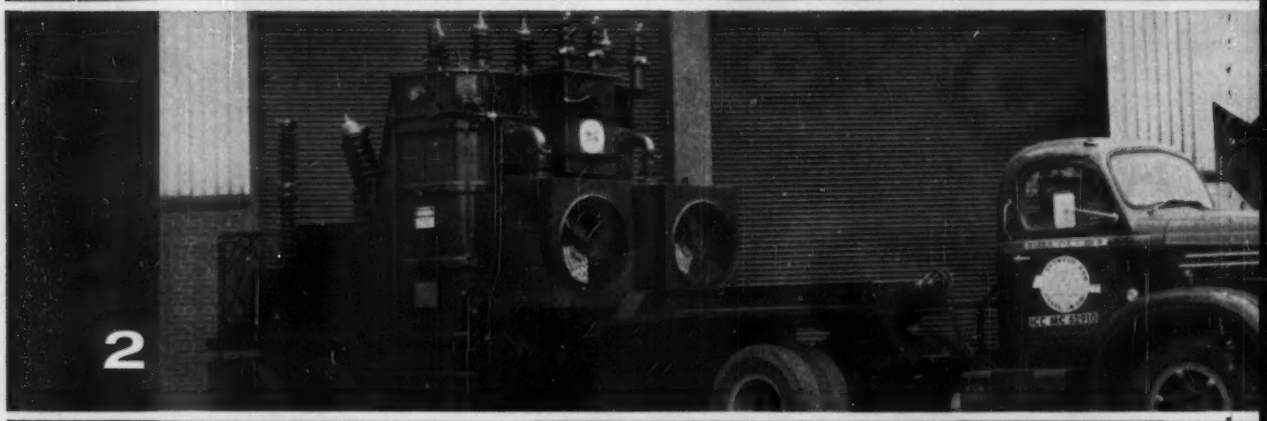
Based on these test results, Philadelphia Electric can predict an unusually long service life for Gulfcrest oil. Why not see for yourself how Gulf Makes Things Run Better! Call your nearest Gulf office or write for informative booklet on Gulfcrest turbine oil. Gulf Oil Corporation, Dept. DM, Gulf Building, Houston 2, Texas.

GULF

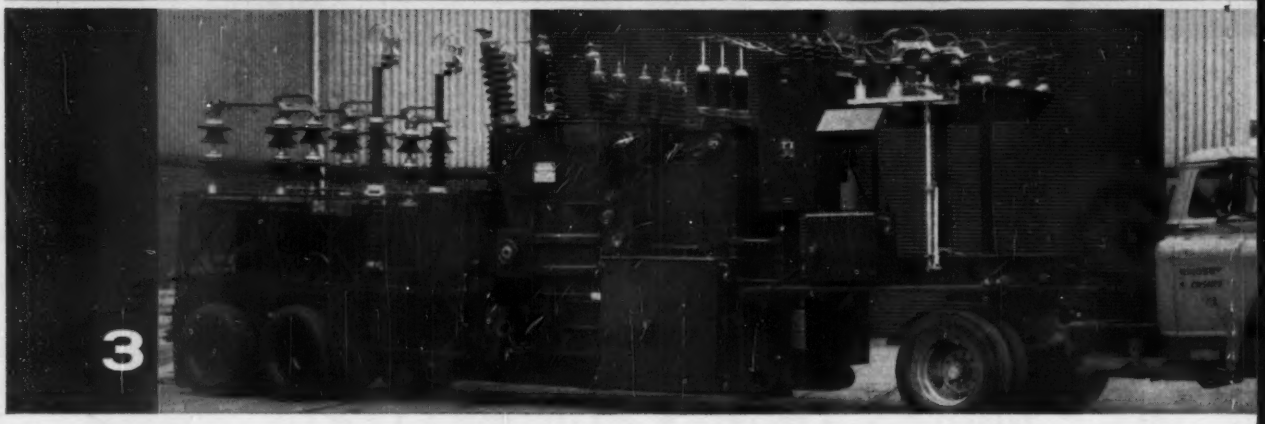
GULF MAKES THINGS RUN BETTER!

Service a la Carte

1



2



3

Service a la carte—versatile Moloney Mobile equipment—custom designed to your specifications—provides capacity for serving new loads, by-passing permanent installations, and restoring service in emergencies. The application flexibility of Moloney Mobiles reduces investment in reserve capacity and assures service continuity over a wide area of your system.

MOLONEY MOBILES

When you buy equipment—remember Moloney Electric's transformer experience and facilities are well suited to provide—service a la carte—mobile units with capacity and voltage combinations to meet a wide range of specific needs.

MOLONEY MOBILES IN SERVICE INCLUDE:

1. 15,000 KVA, H.V. 66 x 132 KV Delta, L.V. 2540/4400Y/2540 x 7620/13200Y/7620 Volts, series-multiple and delta-wye externally operable switches.
2. 7500 KVA, H.V. 60 Grd.Y/34.6 KV, L.V. 12.470 Grd.Y/7200 Volts.
3. 7500 KVA, LTC, H.V. 69.6 Grd.Y/40.2 KV, L.V. 12.470 Grd.Y/7200 Volts.
4. 2500/3125 KVA, H.V. 67 KV Delta, L.V. 2540/4400Y/2540 x 7620/13200Y/7620 Volts, series-multiple and delta-wye externally operable switches.
5. 9000 KVA, H.V. 64.35 KV Delta, L.V. 12470Y/7200 x 24940Y/14400 Volts.

ME61-16

MOLONEY ELECTRIC COMPANY

Manufacturers of Transformers and Switchgear for Utilities, Industry, and Electronic Applications

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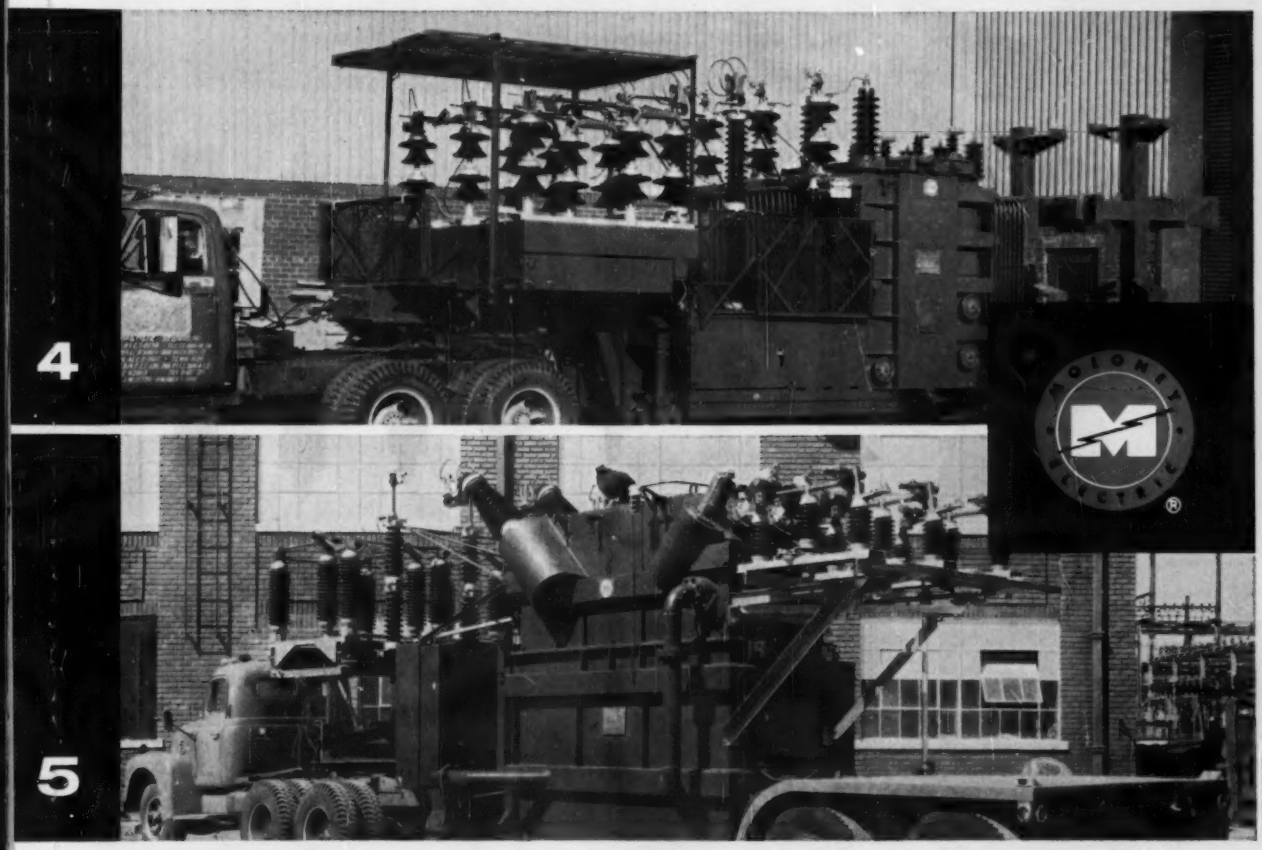

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EXPULSION AND VALVE ARRESTERS

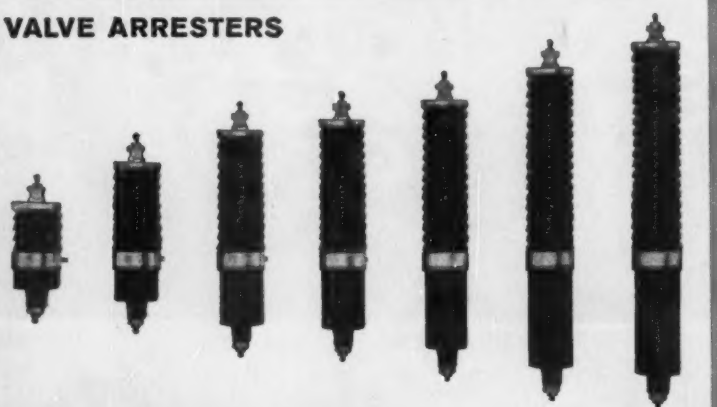
Because There Is A Right Place For Each Type

EXPULSION ARRESTERS

3KV 6KV 9KV 12KV 15KV 18KV

Use where lightning is frequent and severe—where system short-circuit currents are moderate. The ideal rural arrester!

VALVE ARRESTERS



3KV 6KV 9KV 10KV 12KV 15KV 18KV

Use where high system short-circuit currents require the use of valve type arresters. The ideal arrester for densely-populated urban areas.

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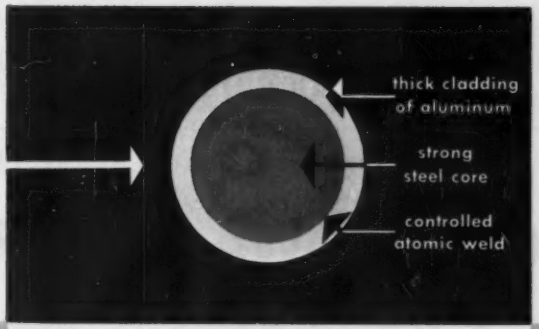
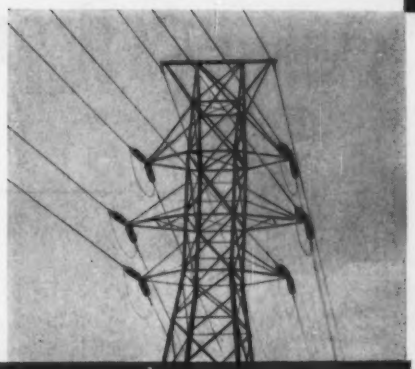
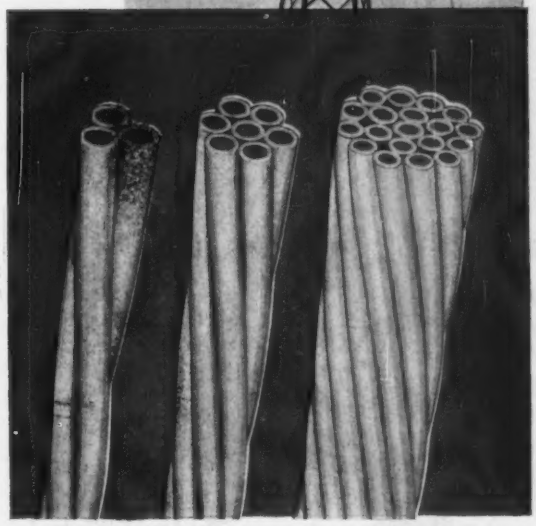
HERE'S THE SECRET OF *LESS OVERHEAD* IN OVERHEAD LINES







ALUMOWELD WIRE AND STRAND

Alumoweld, the only aluminum-covered steel wire with a thick layer of pure aluminum, is made by an exclusive controlled atomic-welding process which assures a ductile and permanent weld between the two metals under all operating conditions. You'll cut overhead costs and assure top performance of your overhead lines when you use Alumoweld for overhead ground wire, guys, messengers and ACSR core wire.

Alumoweld possesses the best features of both aluminum and steel. It has the strength of steel plus the corrosion resistance and conductivity of aluminum. And it's light in weight, easy to handle.

FOR OVERHEAD GROUND WIRES: Alumoweld is just as strong as steel and is 18% lighter. The high strength-to-weight ratio permits stringing with smaller sags, thus increasing the mid-span clearance. Its excellent conductivity—three times that of steel—effectively discharges transient currents to ground. Service interruptions are reduced.

FOR GUYS AND MESSENGERS: Because Alumoweld cannot rust, it assures long, trouble-free life. And it's strong and easy to install.

FOR ACSR CORE WIRE: Alumoweld is the ideal reinforcing material for ACSR conductors because of its high strength and excellent conductivity. And since Alumoweld is compatible with solid aluminum wires, it eliminates the danger of electrolytic action.

ALUMOWELD

Write for Engineering Bulletin E.D. 3000.

COPPERWELD STEEL COMPANY

First from General Electric (1959)... another bright idea that became a better lamp for you

G-E All-Weather Fluorescents shine brighter when mercury drops

Mister Magoo says . . . "1959? A chilly year! Alaska joined the Union, and General Electric invented the All-Weather fluorescent. Happy birthday, All-Weather. Humph! Packaging experts! Who needs a wrapper on a pool cue?"

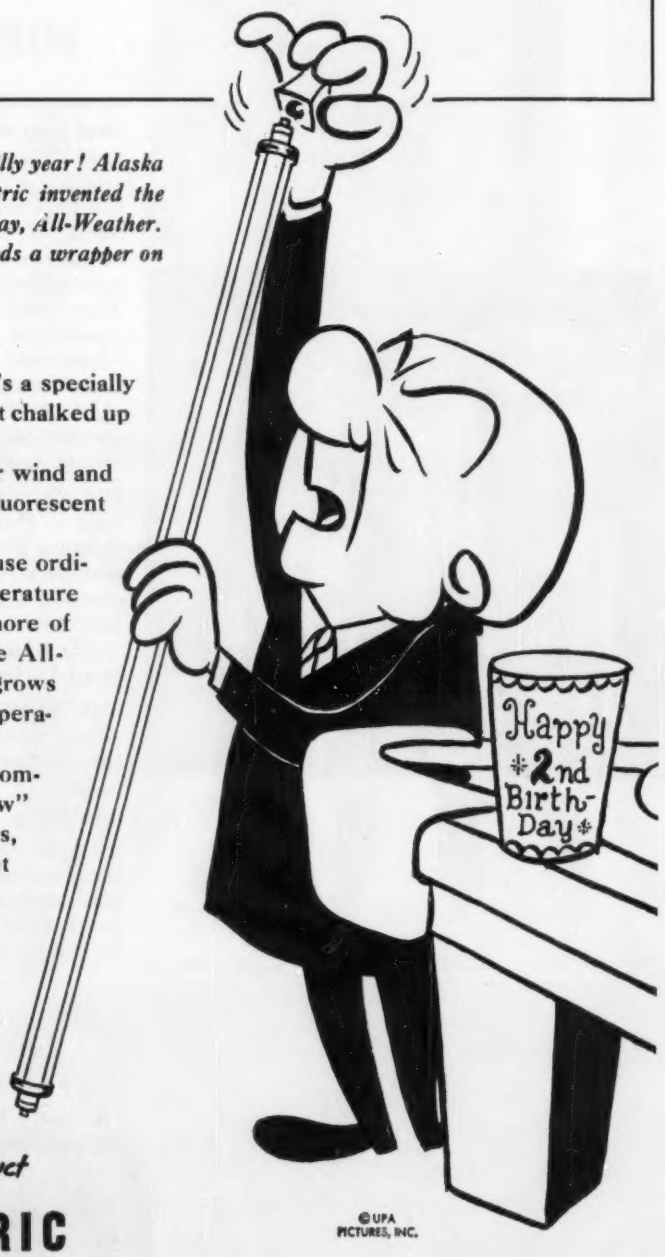
DON'T drop your cue, Mister Magoo. It's a specially jacketed All-Weather lamp, another first chalked up by General Electric.

It wears that glass jacket to ward off winter wind and cold. Below freezing, it's the most powerful fluorescent lamp your customers can buy.

General Electric developed this lamp because ordinary fluorescents grow dim when the temperature dives toward zero. Often they lose 90% or more of their warm-weather light output. But the All-Weather fluorescent T10J—a G-E exclusive—grows brighter the colder it gets! Use it where temperatures sometimes drop below 40°F.

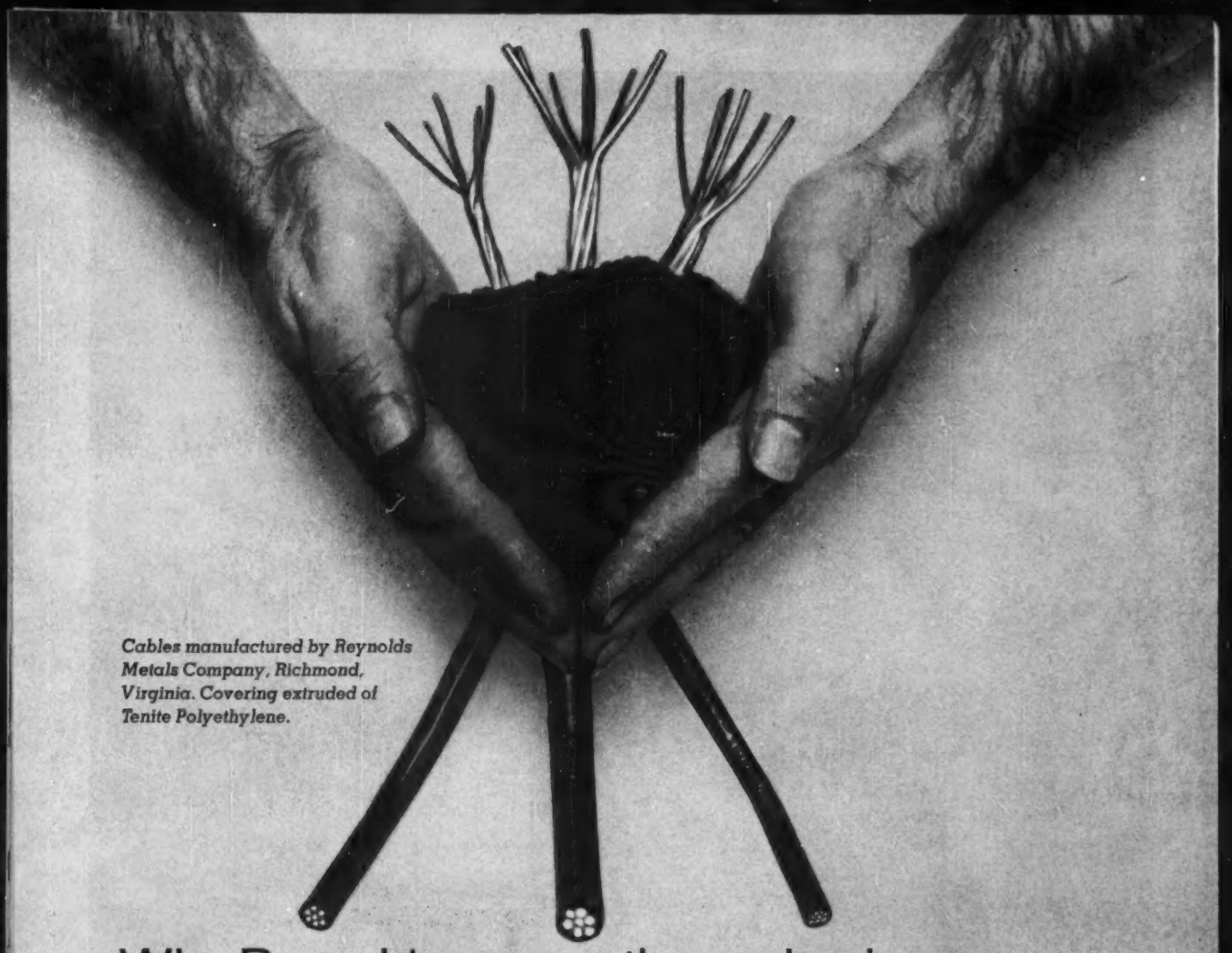
Your customers can use the T10J—or its companion lamp (T10) without the "storm window"—indoors or out. Examples: walk-in freezers, shopping centers, drive-ins, parking lots, street lamps, store fronts, airports, docks, signs, gas stations.

Both come in 4', 6', and 8' lengths. Ask your G-E distributor to show you these two exclusive examples of General Electric lighting leadership. General Electric Co., Large Lamp Dept. C-111, Nela Park, Cleveland 12, Ohio.



Progress Is Our Most Important Product

GENERAL ELECTRIC



Cables manufactured by Reynolds Metals Company, Richmond, Virginia. Covering extruded of Tenite Polyethylene.

Why Reynolds covers these aluminum conductors with TENITE POLYETHYLENE

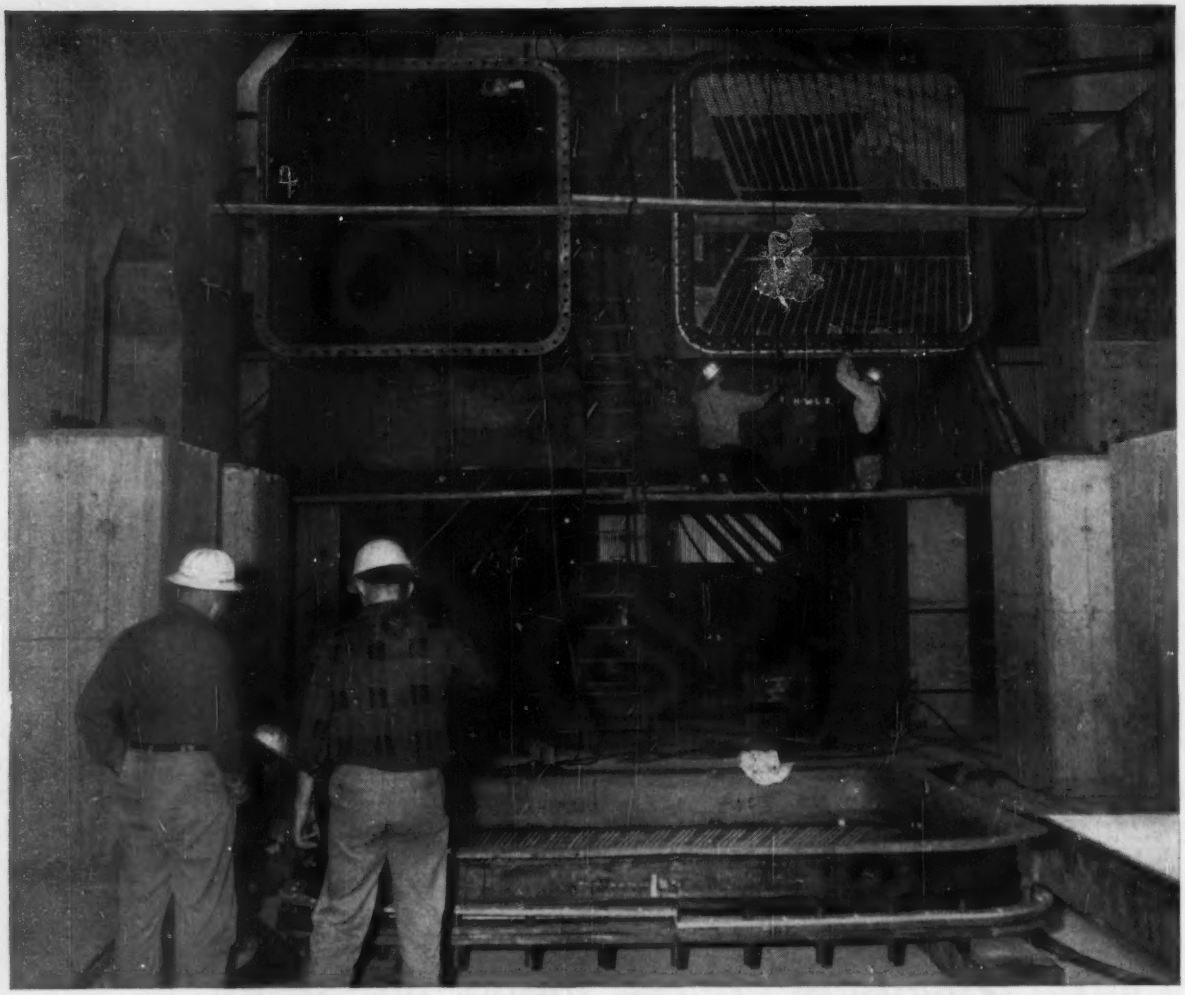
To obtain the highest possible performance from their secondary distribution and service line cables, Reynolds Metals Company chooses Tenite Polyethylene as a covering material.

Tenite Polyethylene is manufactured under as rigid a system of quality control as Reynolds' own aluminum conductors, and makes a tough, weatherproof, fast-stripping covering material which offers high dielectric strength and resistance to abrasion, heat, moisture, chemical attack and stress cracking. It remains flexible even at sub-zero temperatures and its light weight permits easy handling and wide spans. Users report that it gives long service life without festooning or splitting.

Tenite Polyethylene is easily extruded as jacketing or insulation for many diverse applications, from coaxials to control cables, from TV lead-ins to telephone wires. For a material with outstanding electrical, physical and chemical properties, specify Tenite Polyethylene. For further information, write EASTMAN CHEMICAL PRODUCTS, INC., subsidiary of Eastman Kodak Company, KINGSPORT, TENNESSEE.

Both natural and black electrical grade Tenite Polyethylene are available to cable manufacturers in a unique spherical pellet form which flows freely in the extrusion process and in "air-veying" of bulk shipments from truck to bin.

TENITE®
POLYETHYLENE
an Eastman plastic



250,000 KW Steam Generating Unit uses REVERE CONDENSER TUBE

100 Miles of Arsenical Admiralty Tube Installed

New generating unit #3 at SEGCO No. 1 Steam Plant of Southern Electric Generating Company, located on the Coosa River near Wilsonville, Alabama, will add 250,000 KW to the stations's capacity.

Recently installed, the tubes in the surface condenser of this unit are Revere Arsenical Admiralty, chosen to meet water conditions and to resist dezincification. Tubes are 1" OD x 18 BWG x 26 ft. 2¾" long—21,600 of them are being used, amounting to more than 100 miles in length (566,500 feet or some 315,000 pounds).

No matter what the combinations of water, temperature and other service conditions may be, Revere has a tube to meet your requirements exactly. Talk your needs over with your nearest Revere Technical Advisor, either for new equipment or re-tubing present installations. He's available through any Revere District Office.

SEGCO No. 1 plant, Coosa River near Wilsonville, Alabama—another modern generating plant using Revere Condenser Tube.

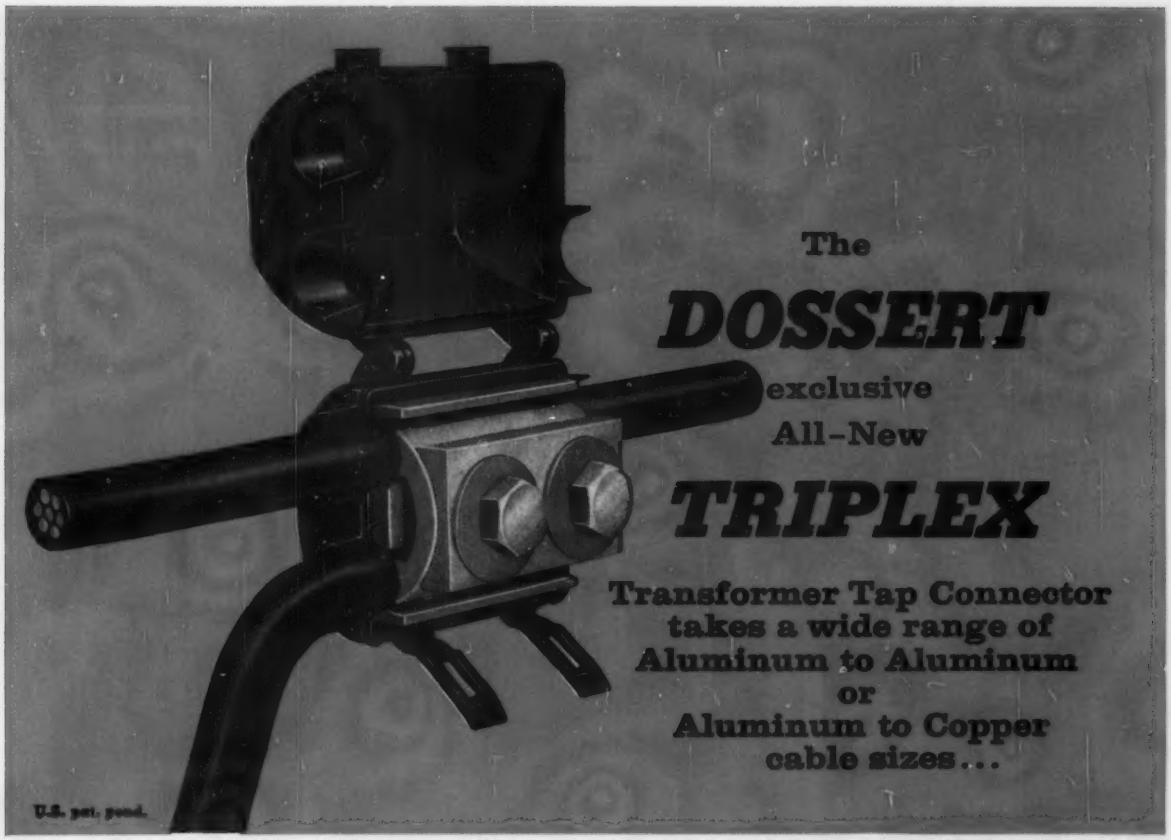
REVERE

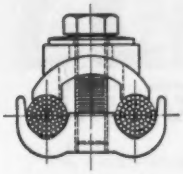
COPPER AND BRASS INCORPORATED

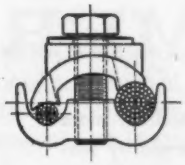
Founded by Paul Revere in 1801

230 Park Ave., New York 17, N. Y.

Mills: Rome, N.Y.; Baltimore, Md.; Chicago and Clinton, Ill.; Detroit, Mich.; Los Angeles, Riverside and Santa Ana, Calif.; New Bedford and Plymouth, Mass.; Brooklyn, N.Y.; Newport, Ark.; Ft. Calhoun, Neb. Sales Offices in Principal Cities. Distributors Everywhere







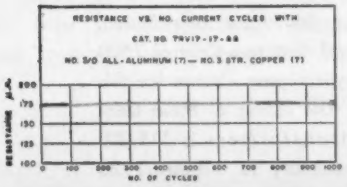
. . . in both grooves, because it is self-leveling. The TRIPLEX line of transformer tap connectors is the final result of intensive research by DOSSERT engineers. The TRIPLEX combines the efficient electrical properties of a parallel groove clamp along with a high dielectric strength polyethylene insulating cover to form an easy-to-install, completely insulated connector.

The TRIPLEX (type TRV) incorporates several unique features, that attribute to its high strength and extremely stable electrical characteristics.

1. A tangential plate, that receives the bolt clamping pressure and redistributes it uniformly over the arc of the clamping cap.

2. The tangential plate also establishes a flat surface perpendicular to the axis of the bolt for any combination of cable sizes. Perpendicularity is maintained even with connector holding a maximum cable in one groove and a minimum in the other.

3. To assure full clamping pressure during the thermal change caused by varying electrical loads, the connector has dish-shaped Belleville spring washers under the head of each bolt that permit expansion or contraction of the connector with constant spring loaded pressure on the clamping members.



TRIPLEX heat cycling test shows negligible change in resistance!

An established current level of 330 amperes drove the conductors to a minimum temperature of 125°C. The on-time was 20 minutes and the off-time 40 minutes. The curve shows negligible resistance change throughout the entire 1000 cycles.

Write for illustrated literature.

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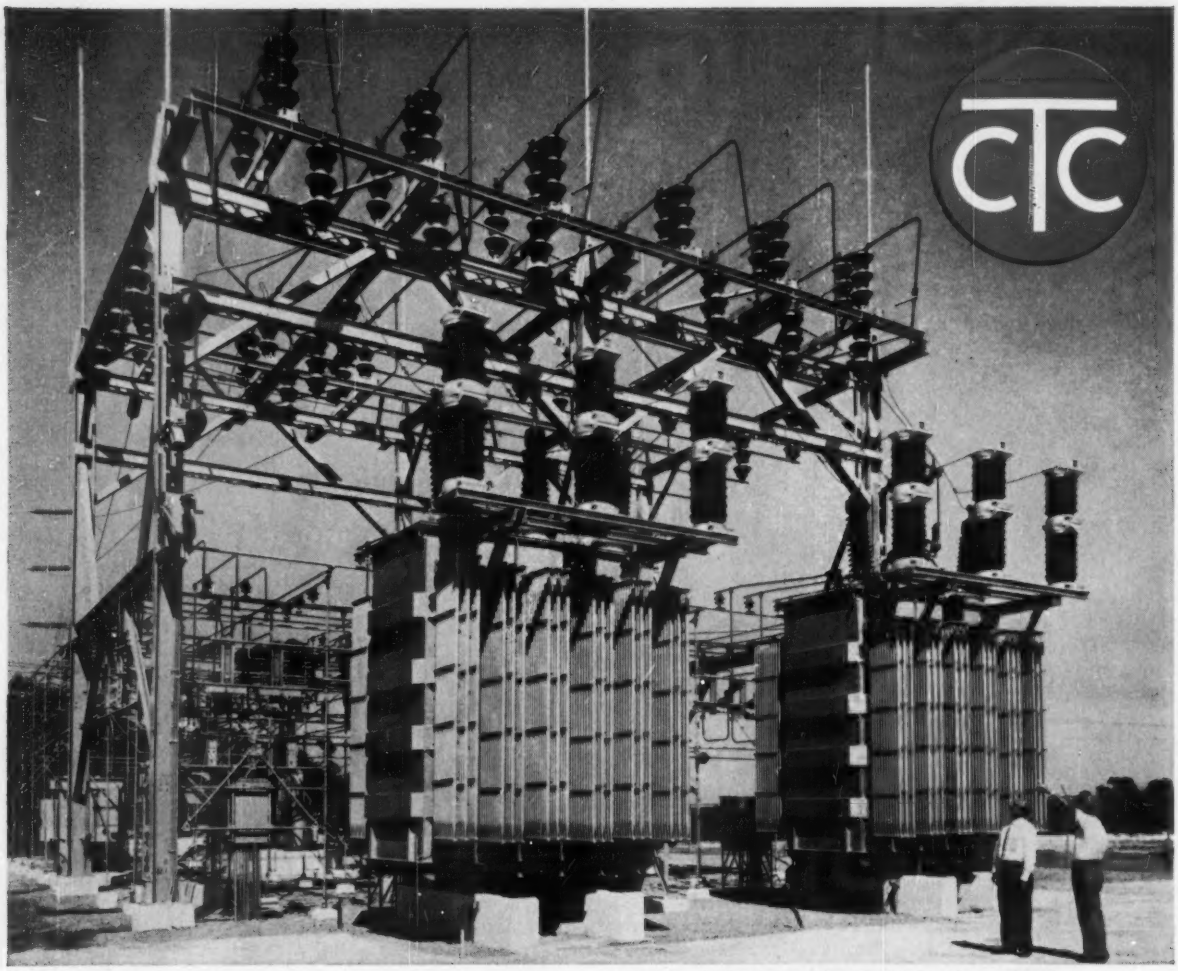


William H. Rutledge, district supervisor, and R. L. Johnson, administrative assistant, of Florida Power & Light Company inspect new South Daytona Beach substation installation.

CENTRAL POWER TRANSFORMERS

IN SERVICE AT FLORIDA POWER & LIGHT COMPANY'S SOUTH DAYTONA BEACH SUB-STATION

Fast-growing Florida's need for more electric power is being served by substations such as the one shown above, located near South Daytona Beach. We are proud that two Central 7500 Kva transformers were chosen for this installation. The rating of these Central power transformers is 115,000 volts delta primary to 13800Y/7980 secondary.

CENTRAL CTC

Sales Offices in Principal Cities

Transformer Corporation

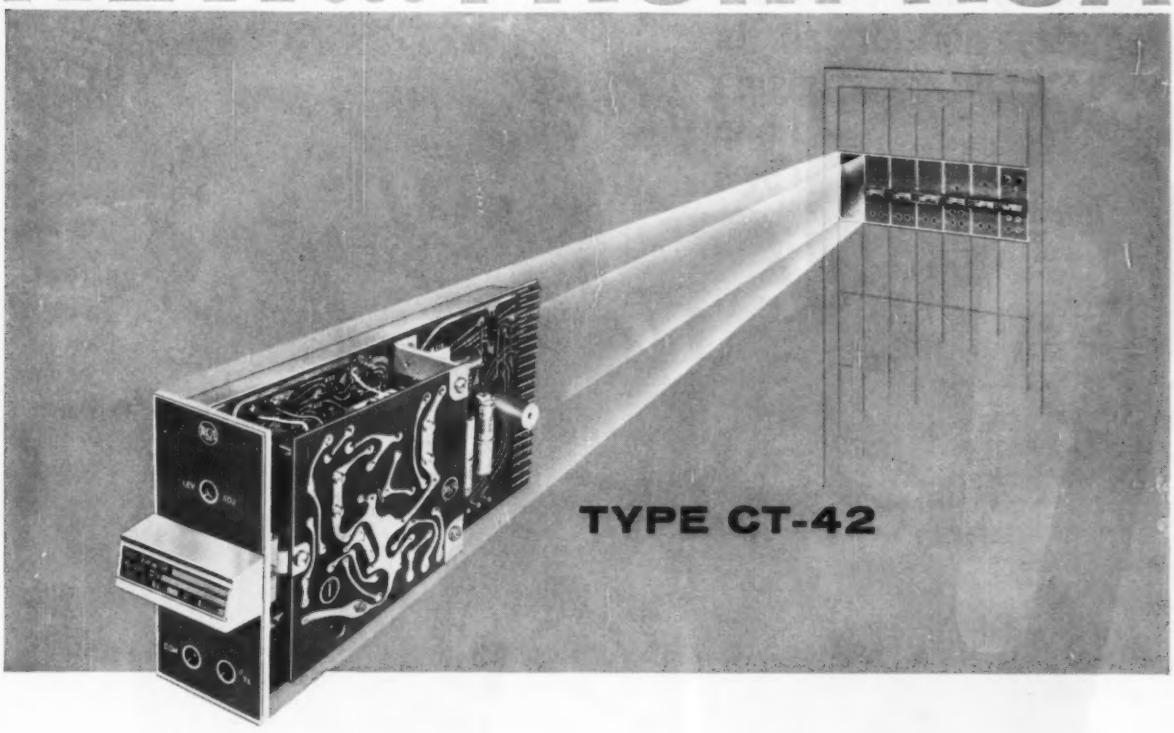
Telephone JEfferson 4-5332

PINE BLUFF, ARKANSAS

Plants at Pine Bluff, Arkansas, and Arcadia, Florida

NEMA

NEW... FROM RCA



SOLID STATE TONE MULTIPLEX

FOR WIRELINE, MICROWAVE OR CARRIER

24 channels from 420 to 3180 cps—Spaced every 120 cycles (CCITT Standards)
18 channels from 4300 to 7600 cps—Spaced 170 to 220 cycles

The CT-42 is an all new tone multiplex of high performance designed to operate over a wide environmental range. Ruggedly built, it uses computer grade components for lasting dependability.

Each channel can be frequency-shift or AM keyed for teletype, telemetering, control or data signals. Six transmitters or receivers in any combination may be plugged into a standard shelf which also contains a husky regulated power supply.

Channel units operate from 24 V DC or 117 V AC power supply.

If you are looking for the newest and best in tone multiplex equipment, mail the convenient coupon for complete specifications and prices.

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The Most Trusted Name in Electronics

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RADIO CORPORATION OF AMERICA
Microwave Equipment, Dept. XB-45
Building 15-5, Camden 2, N.J.

☐ Please send new catalog sheet and price list on Type CT-42 Tone Equipment.

NAME_____ TITLE_____

COMPANY_____

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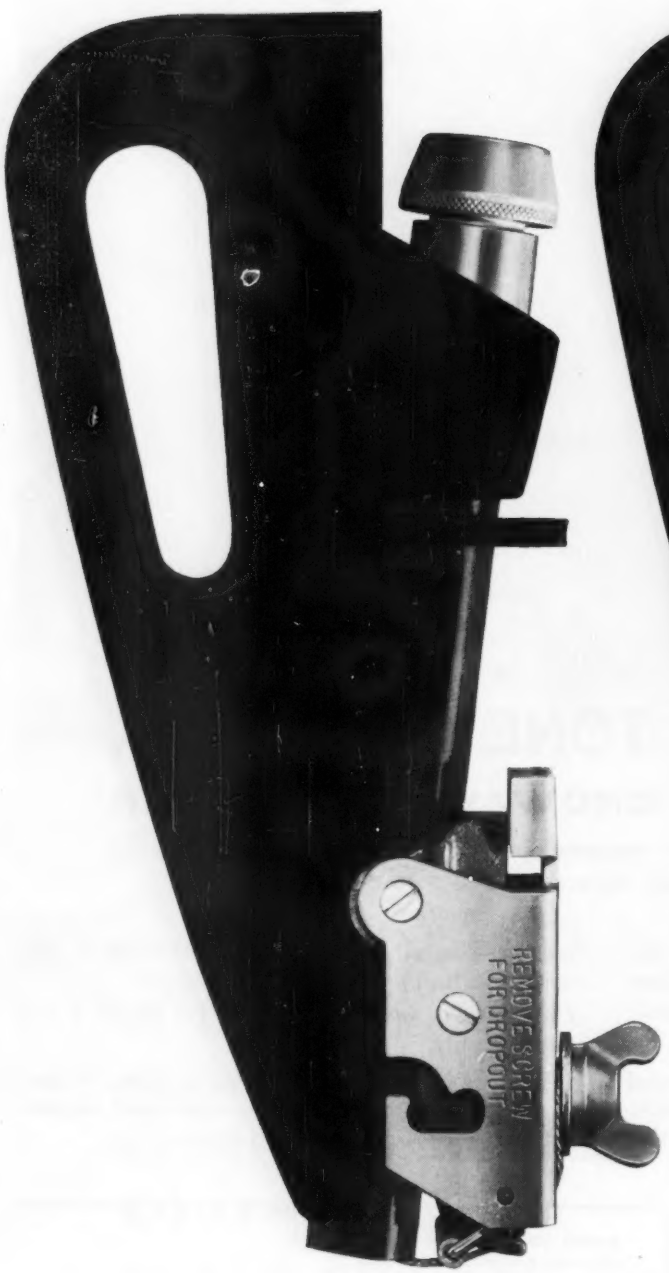
CITY_____ ZONE_____ STATE_____



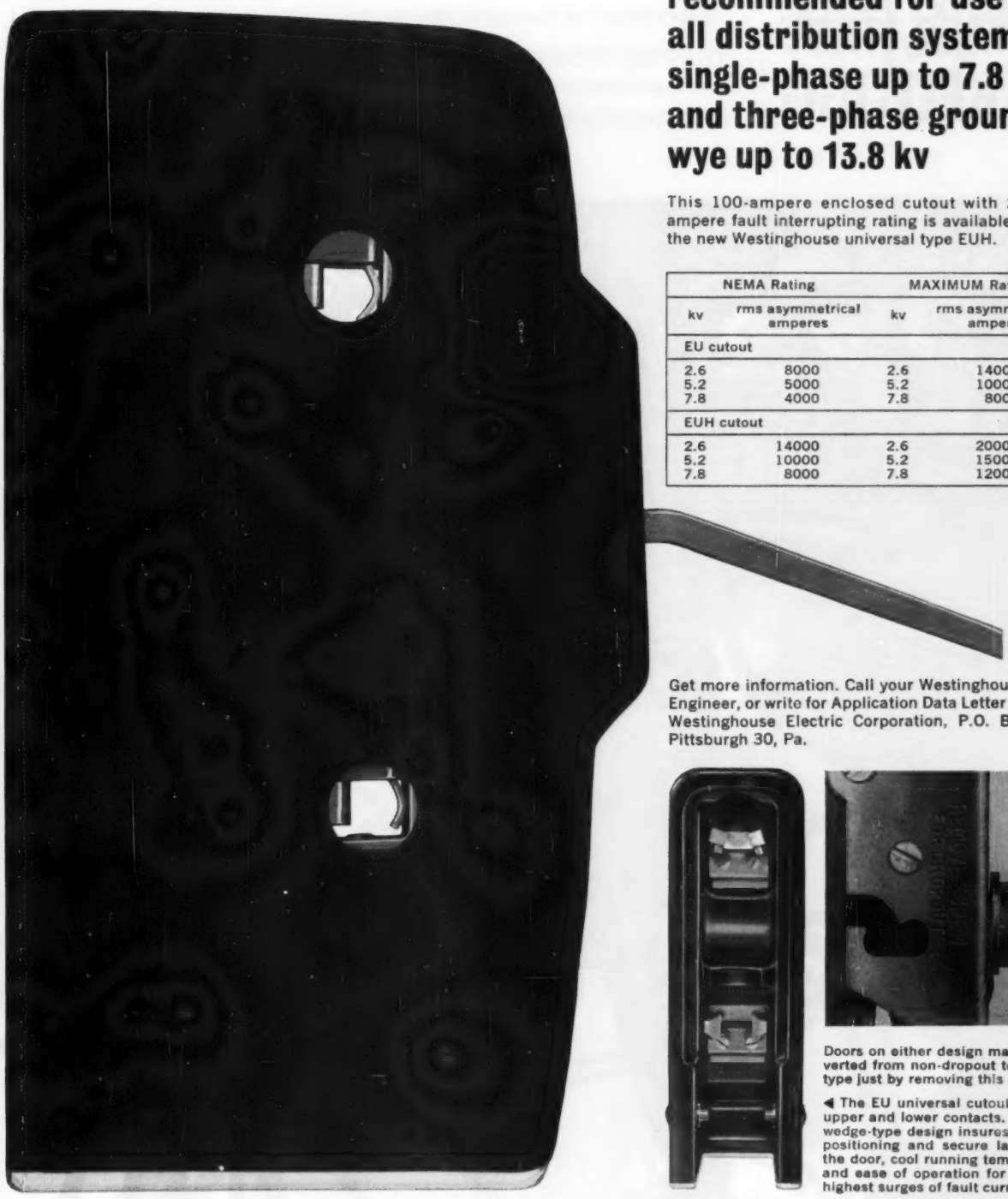
This door interrupts up to 14,000 amperes

This door interrupts up to 20,000 amperes

Westinghouse universal cutout recommended for use on all distribution systems single-phase up to 7.8 kv and three-phase grounded wye up to 13.8 kv

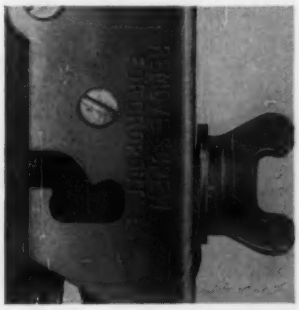
This 100-ampere enclosed cutout with 20,000-ampere fault interrupting rating is available only in the new Westinghouse universal type EUH.

NEMA Rating		MAXIMUM Rating	
kv	rms asymmetrical amperes	kv	rms asymmetrical amperes
EU cutout			
2.6	8000	2.6	14000
5.2	5000	5.2	10000
7.8	4000	7.8	8000
EUH cutout			
2.6	14000	2.6	20000
5.2	10000	5.2	15000
7.8	8000	7.8	12000



They both fit this box

Get more information. Call your Westinghouse Sales Engineer, or write for Application Data Letter CR61-2. Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. J-65001



Doors on either design may be converted from non-dropout to dropout type just by removing this screw.

◀ The EU universal cutout has new upper and lower contacts. This new wedge-type design insures accurate positioning and secure latching of the door, cool running temperature, and ease of operation for even the highest surges of fault current.

You can be sure . . . if it's

Westinghouse

IN POWER PIPING ERECTION

QUALITY COMES FIRST AT KELLOGG

Field erection by Kellogg of power piping made by Kellogg at its new Williamsport plant assures the highest standards of engineering and workmanship. Quality and strict quality control are reflected in every phase of Kellogg field erection.

Making Kellogg responsible for both manufacture and erection, as many electric utilities do, also can mean marked economies in the over-all power piping contract.

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POWER PIPING

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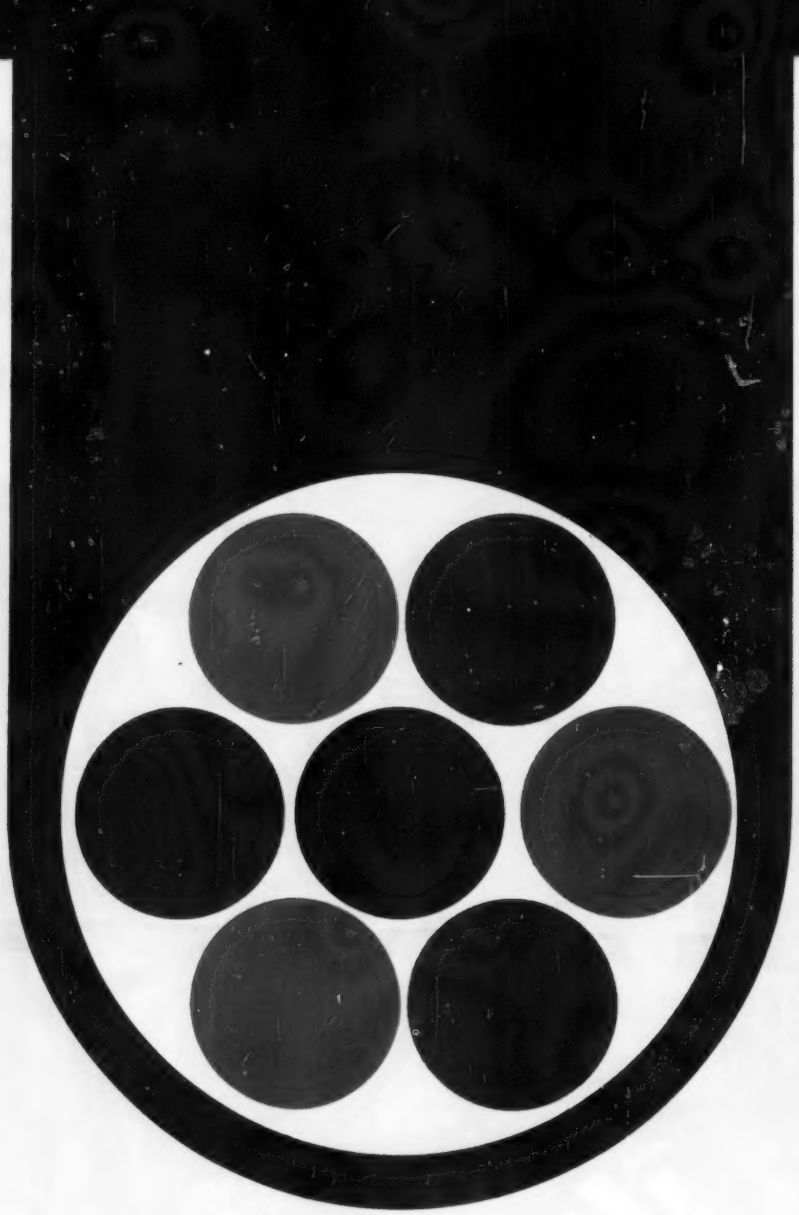
HEADQUARTERS



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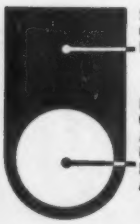

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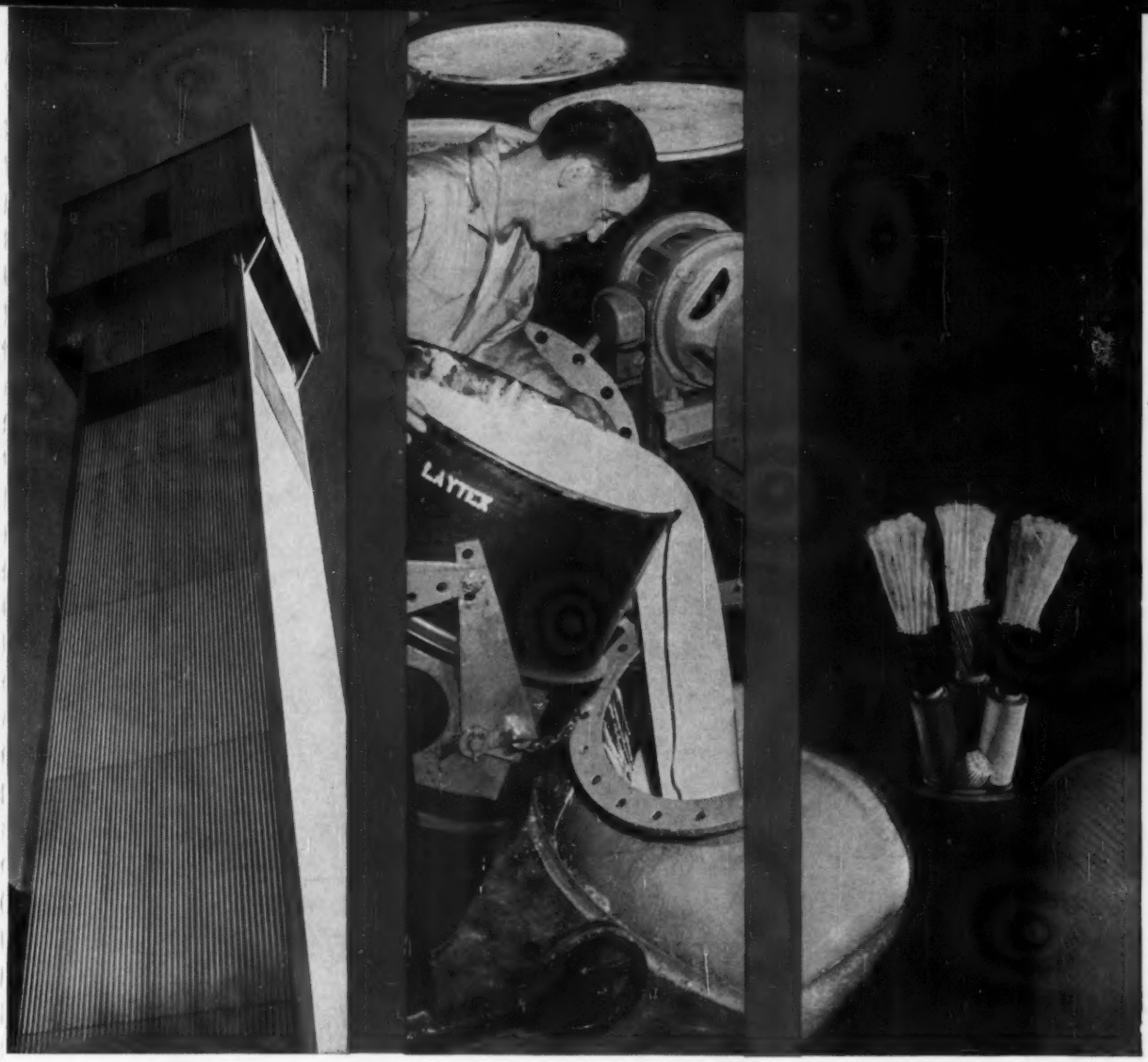

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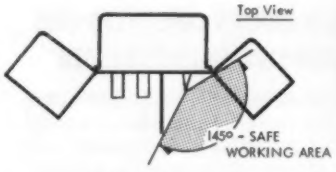

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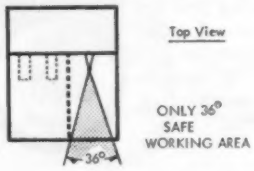

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Editorial Comment

JULY 10, 1961

Advocates Are Not Facing Up to Hanford Power Costs

Despite the economic studies made by four or five separate groups, the fact remains that neither the Administration nor the majority of the Joint Committee on Atomic Energy is willing to face squarely up to the costs of generating a large block of power at the Hanford New Production Reactor (NPR).

The Committee majority, in urging approval of electric generating facilities at the NPR, concluded that power generation would "yield benefits expressed in units of millions of dollars." Perhaps significantly, the majority did not make it clear whether it meant that the benefits would be in excess of the costs.

The statement of the five committee members opposing the NPR power facilities noted that testimony and studies had indicated a power cost ranging from 3.7 mills to 5 mills per kwhr at the bus bar, compared with an average of 1.61 mills paid by the Bonneville Power Administration for power in 1960. The minority broadly hinted that Bonneville will either have to raise its rates or incur even larger deficits than it has at present if it is to pay the full cost of the NPR power.

One minority member has assembled figures which indicate that Hanford generation during the power-only phase would cost $11.5 million per year more than BPA's current selling price for such a block of power.

Debate on the matter during the next few weeks should bring out whether BPA is willing to increase its rates to pay the costs of Hanford generation, or whether the Atomic Energy Commission intends to absorb a large share of the cost as an outright subsidy to BPA power customers.

Now to Meet Gas Industry's Counterattack

The gas companies are poised for an all-out assault to ban the electric line completely from many new commercial establishments. Thus they seek to turn the tables on the electric industry, which is trying—but not hard enough—to achieve just the opposite result.

Speculation on the all-gas establishment has been rife in recent years. But most of the wild-swinging gas industry propaganda has centered on visions of the gas-supplied "black box" under the residential sink. Such "exotic" energy converters, they say, eventually will put out the kwhr for the household (after gas is used directly for space and water heating, air conditioning, cooking, drying, refrigeration and incineration).

With such feinting as effective cover, the gas industry quietly has bent efforts to using the fruits of today's technology in today's situations. With the competition's eyes drawn to the home, they've shifted the attack to the commercial load.

Electrical World, June 26, p 44, gave a rundown on some events actually transpiring. There are at least a handful of full-scale commercial projects in service today which do not have electric utility service. Gas-fired gas turbines or engines power generation for all electric needs while their waste heat is utilized for heating and air conditioning.

The day of the all-electric shopping center, school, hospital, office building and apartment house was practically upon us—we thought. It may come as a shock to think we may lose the concept of the single-energy supply to the competition before we got full possession of it.

It may be too early to tell whether the gas industry's efforts constitute a really serious, long-term threat, or whether its pioneering projects are isolated cases of over-enthusiastic promotion.

It is not too early to find out what they are up to. And it's not too early to plan aggressive reaction against such bold counterattacks.

Sutherland answers newsmen's questions as . . .

Atomic Plant Is Announced by PG&E

One of the largest atomic power plants in the world will be built by Pacific Gas & Electric Co at Bodega Bay 50 miles north of San Francisco.

Applications to the Atomic Energy Commission and the California Public Utilities Commission for necessary licenses will be made soon, according to Norman R. Sutherland, president of the company.

The plant will have a capacity of 325 Mw gross and 313 Mw net, and a thermal efficiency of 32.5%. PG&E estimates that the cost of electricity at the generator bus bar will be 5.62 mills per kwhr on the first core, which compares favorably with an oil-fired conventional steam plant of the same size at that location. The latter would produce power at an estimated 5.77 mills per kwhr with oil costing $2.25 a bbl, or 6.82 mills per kwhr with oil costing $3 a bbl. This is based on a 90% capacity factor. It is estimated that power production costs would be cut to 5.32 mills per kwhr on the second core.

General Electric Co will furnish the reactor, turbine-generator, and all major electrical apparatus in the plant. The $61-million cost of the plant includes voltage step-up transformers and switching station. No costs are allocated to research and development, and there will be no subsidies from the AEC nor contributions from any other source.

Fabrication by GE of the first load of fuel will cost $8.5 million. At about $60 per lb and 4.75% annual use charges, the fuel use payment to AEC figures at about $425,000 per year. Add insurance, interest, fuel use charges, apportionment of fabrication cost over 3½-year life together and the total comes close to $5 million a year allotted to fuel cost.

The reactor will be a direct-cycle, boiling-water reactor with forced circulation and internal steam separation. This differs from PG&E's 50-Mw Humboldt nuclear unit now under construction, which has natural circulation. The fuel will consist of 75 tons of uranium oxide enriched to 2½% U-235. Estimated core life is 3½ years, and fuel pellets will be in stainless steel tubes. Fuel will produce energy at the rate of 15,000 Mw-days per ton.

As at Humboldt, pressure suppression containment will be used, with the reactor enclosed in below-ground concrete and steel structure 120-ft dia and 100 ft deep. The turbine will be tandem-compound, single shaft, operating on saturated steam at 1,000 psi and 544F. Sea water evaporators capable of purification to ½ ppm will supply reactor coolant, moderator and plant auxiliaries.

Subject to obtaining the required licenses in time, construction will start in August 1962 and the plant is expected to attain full power by December 1965, at which time PG&E total generation should be about 9,000 Mw.

PG&E will design the plant and act as its own construction manager.

Power from the plant will be transmitted to Ignacio substation about 20 miles away at 220 kv.

Bodega Bay Atomic Park will be built on a 225-acre site at the south end of Bodega Head, the narrow peninsula that separates Bodega Harbor from the Pacific Ocean. PG&E owns 160 acres of the site and is negotiating for purchase of the additional land.

The proposed plant is to be situated inland from Campbell Cove near Bodega Harbor. Cooling water will be drawn from Campbell Cove near the entrance to Bodega Harbor and discharged through a tunnel running west to the ocean. PG&E has considerable experience with sea water conversion because of an installation at Morro Bay plant.

The company reports that the recent change in AEC fuel charges and the Supreme Court decision in favor of Enrico Fermi had no effect on their considerations, though they are encouraging.

General Electric, when approached for comment, said:

"The new PG&E nuclear power plant will be a large step in further compaction of atomic plants to reduce capital costs—one of many goals of the General Electric technical development program.

"Among the most significant improvements will be pressure suppression tested by GE and PG&E in a joint program for the Humboldt Bay plant, and also internal steam separation."

- Los Angeles accused of starting delaying action before FPC
- Arizona Power Authority moves that Los Angeles plan be stricken
- Bridge Canyon project becomes involved in the public power battle

Fight Starts Over Marble Canyon

Bickering has broken out between Arizona Power Authority and the City of Los Angeles over hydroelectric developments on the Lower Colorado River.

A seeming truce between the two rival FPC license applicants—leading to possible agreement on development of the Bridge Canyon and Marble Canyon projects—now appears to be shattered.

First shots in the new attack have come both from the Los Angeles Department of Water & Power and from the Metropolitan Water District of Southern California. The two are opposing Arizona's Marble Canyon project as inadequate and "not best suited" for the Colorado River's stretch between Glen Canyon Dam and the Grand Canyon National Park.

Arizona Is First Applicant

Arizona is sole applicant for a 510-Mw capacity Marble Canyon dam and powerhouse, but Los Angeles and the Water District—intervenors in the case—have proposed a mammoth alternate project, involving a 43-mile tunnel from Marble Canyon Dam to a powerhouse at Kanab Creek at the northern edge of Grand Canyon Park.

Details of the alternate plan are staggering: cost, $1,095,388,000; rated power capacity, 2,030 Mw; peaking capacity, 2,300 Mw; a 43-mile, 36-ft diameter, concrete-lined water diversion tunnel, at one point nearly 6,000 ft below ground, carrying water from a 400-ft Marble Canyon dam to a similar-sized Kanab Creek dam. The Kanab Creek power plant would have seven 215-Mw generators, three 167-Mw generators, and a small, 30-Mw unit would also be installed at Marble Canyon to use water flows left in the Colorado River. The Los Angeles-Water District plan calls for three 380-kv transmission lines from Kanab Creek to the Hoover Dam grid, carrying power to California.

Under the Californians' plan, 1,050 Mw of capacity would be reserved for them: 531-Mw capacity would go to Arizona. This, they claim, would give Arizona more power than the alternate plan calling only for a 510-Mw development at Marble Canyon.

The alternate Kanab Creek plan is so huge that federal development probably would be required. Both Los Angeles and the Water District have indicated in their recent alternate plan that they would like Congress to study possible federal construction of the project.

The Kanab Creek plan, however, was not filed with the FPC as an alternate license application but as evidence in Arizona's Marble Canyon application hearing and Dale Doty, Arizona's attorney, has moved for the plan to be stricken from the record as having a "complete absence of any bearing" on the Marble Canyon application. "The whole thrust . . . is to seek delay . . . in order allegedly to permit further study of the Kanab diversion scheme preliminary to taking of a position on possible federal construction," he charged in his motion to strike.

The Kanab plan is based on a 2.623% interest rate—the same as used for the Upper Colorado River project. Generating facilities would cost $698,301,000; transmission would cost $145,467,000, Los Angeles estimates.

Purpose of the Kanab plan is to use undeveloped head between Marble Canyon and the lower edge of the Grand Canyon. A legal problem of encroachment in the park has stymied previous development, because the FPC cannot issue a license for development in a park. By diverting water around the park in a tunnel to Kanab Creek, the Los Angeles plan would use most of the available head. This raises another problem of how much water could be diverted from the river before detracting from scenic beauty in the park—an issue raised in the Niagara power project.

The Kanab Creek plan is similar to a 1945 plan by the Bureau of Reclamation to build a 1,100-Mw plant at the site.

Marble Canyon previously had caused less controversy between Arizona and Los Angeles than the Bridge Canyon fight, farther downstream. Both filed applications to build Bridge Canyon—after a long-simmering dispute—but only Arizona included Marble Canyon in its plan. Because of this, Marble Canyon was severed from the conflicting Bridge Canyon fight.

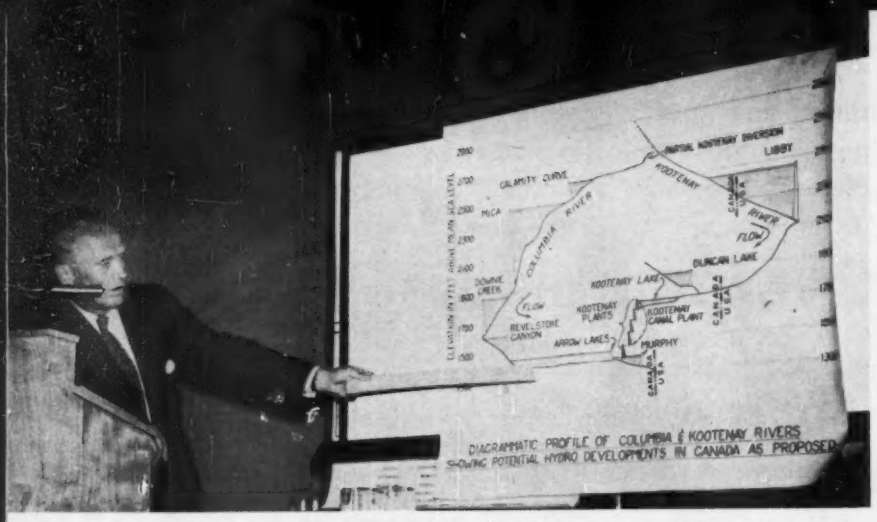
Arizona had proposed a 400-ft dam with a 960-Mw power plant at Bridge Canyon, costing about $193 million; and Los Angeles proposed a 466-ft dam with a 1,200-Mw generating capacity, costing about $229 million.

Action on Bridge Canyon Halted

Presently, the Bridge Canyon case has been postponed, looking to possible agreement or joint development of the project between Arizona and Los Angeles. The applicants must request a new FPC hearing within six months after the Commission's final ruling on Marble Canyon, or face dismissal of both their competing applications on Bridge Canyon.

The heated battle over Marble Canyon indicates the two parties may remain at odds over Bridge Canyon. In such event, again, the federal power shadow is hovering. The Bureau of Reclamation has never given up its dream of building the project, and Assistant Interior Secretary Kenneth Holum recently commented that he envisions a 1,500-Mw development at the site—a capacity not mentioned in applications of either Arizona or Los Angeles.

Federal development at either Marble Canyon-Kanab Creek or Bridge Canyon or both would be advantageous to Los Angeles and the Water District, because they would be able to hook onto the federal power grid into their area.



Canada Treaty Tied to California Market

PROJECTS TO BE DEVELOPED in British Columbia if Canada ratifies the treaty for joint development of the Columbia River are reviewed by Gordon Tallman, civil planning engineer, British Columbia Hydro

Northwest Public Power Association told of 3,700-Mw Alaska hydro plan, possible 2,500-mile dc link to Seattle

It may be that we shall need the intertie to California to get the treaty with the Canadians for joint development of the Columbia River, Bernard Goldhammer, power manager for Bonneville Power Administration, told the Northwest Public Power Association at Salem, Ore., recently.

Reminding some 200 participants in NPPA's Engineering and Operations Workshops that the US has ratified the treaty but Canada has not, Goldhammer said a new element in consideration of the treaty within British Columbia is the availability of a market in the US for some of Canada's share of the benefits. It is natural to look to California for this market because Canadian power is likely to be higher priced in the Northwest than Bonneville rates, which are expected to hold their level for a long time.

Canada and the US would each have 1.3 million kw of peaking power and 740,000 average kw from the joint developments included in the treaty. It would cost only $8.70 per kw-year in US plants to take advantage of the additional storage because much of the investment has already been made in existing facilities. This is about half the current rate for new power projects on the Columbia.

A new 345-kv transmission line is contemplated in the BPA budget to be built from Snohomish, Wash., to Blaine at the Canadian border for exchange of power and to deliver surplus Bonneville power to BC Electric under a recent contract. Two lines are also being considered to carry power from the proposed New Production Reactor at Hanford to the Puget Sound area. Power would be available from the first generating unit at NPR in Oct. 1964 and from the second unit a year later for a minimum total of 550 Mw, according to present plans. This schedule would permit marketing 400 Mw of additional firm capacity as soon as the power facilities at NPR are authorized.

Goldhammer also remarked that proposed legislation to preserve the prior rights of the Northwest to power from government plants on the Columbia in the event an EHV tie is built to California has been mailed to all BPA customers for their comments and suggestions.

Reporting on the May meeting of the Rampart Economic Advisory Board of the Corps of Engineers, NPPA executive secretary Gus Norwood said the basic question to be answered in determining economic feasibility of the Rampart project is whether the tremendous amount of power could be absorbed in Alaska over a 15-year period. About 33 billion kwhr per year would be generated, about as much as the 17 federal projects in the Columbia Basin are now producing (EW, April 24, p 45).

The Rampart project would be capable of producing 3,735 Mw of prime power. The proposed concrete dam, about three-fourths as large as Grand Coulee, would be on the Yukon River. It would create an average head of 440 ft from which the annual drawdown would be only four feet from the reservoir of 1,252 million acre-ft.

Assuming the release of 25% of river flow during the storage period, filling the reservoir would require 19½ years. A tentative construction period starting in 1966 would provide for initial power (350 Mw) in 1972. High-voltage transmission would deliver the power 400 miles to the tidewater cities of Alaska, including Juneau and Anchorage, where the cost of power would be slightly more than two mills at full power (10 mills at initial generation). The Corps of Engineers will also consider dc transmission to Seattle over a distance of 2,500 miles, said Norwood.

Keen interest in progressive ideas to keep ahead of load growth and service problems was evident in the workshop meetings. One of those problems concerns the difficulty of finding technically trained personnel, remarked Loren Holden, electrical superintendent, Richland, Wash. Prof L. N. Stone, stating that only three graduates of the 1961 class at Oregon State University were attracted to the utility industry, replied that the industry itself was to blame. The young engineer is concerned with the problem of technological obsolescence. He wants to advance his knowledge to the full extent of his capabilities and he

wants to contribute to our technological progress, emphasized Stone. R. W. Martin Jr, chief engineer of Eugene Water & Electric Board, said that surely the utility industry is filled with opportunities for the imaginative engineer with the courage to demonstrate his untried ideas.

An economic comparison between 4 kv and 26 kv to serve load under equal conditions in Seattle resulted in a $23-per-kw cost of diversified load in favor of the 26-kv primary, reported Lyle Gleason, Seattle City Light. In addition, 26 kv would be favored by a saving from thermal capability because the minimum standard for 26-kv laterals is well in excess of the maximum load they can reach.

F. H. Lehman, chief engineer of Clark County PUD No. 1, urged installation of residential underground systems in new subdivisions in an effort to satisfy customers' desire to reduce the number of poles and overhead lines. The Clark system is designed in anticipation of 100% electrified homes with 200-amp services. "We charge the developer $350 per lot but refund $200 when electric heating has been installed," said Lehman. The $350 figure is the difference between the $500 cost for underground service with electric heating and $150 for overhead without electric heating.

Indiana Utilities Fight Hoosier G&T Project

Five Indiana investor-owned utilities have launched a state-wide public campaign to fight the record Rural Electrification Administration loan approved for 17 REMCs.

They ran full-page newspaper advertisements in all Indiana newspapers Sunday, June 25. Major dailies not publishing on Sunday ran the ad the following day.

The companies are laying groundwork to oppose at Public Service Commission public hearings the granting of a certificate of convenience and necessity to Hoosier Cooperative Energy, Inc, to build a generating plant.

The five companies are Indiana & Michigan Electric Co; Indianapolis Power & Light Co; Northern Indiana Public Service Co; Public Service Co of Indiana; and Southern Indiana Gas & Electric Co.

USBR and Omaha Power Try Power Exchange Plan

The summer flow of the Missouri River is being used to meet South Dakota's winter power demands under an arrangement that recently went into effect.

Participants in the set-up are the Omaha Public Power District and the Bureau of Reclamation, marketing agency for power produced by the Army Engineers' Missouri River dams in the Dakotas and Montana.

The exchange arrangement, which is equivalent to depositing kwhr in a "bank" to be drawn on in time of future need, is keyed to two circumstances of the Missouri Basin. They are:

1. The differing peak periods of Omaha Public Power District and the area in South Dakota served by the Bureau. OPPD, with an urbanized load heavy on air conditioning and refrigeration, has its period of peak demand in the summer. The South Dakota area, by contrast, has its peak demand in the winter.

2. Navigation needs. Below Sioux City, Ia., the Missouri River is maintained at a depth sufficient to operate towboats during the summer navigation season by stepping up the releases of water stored behind the upstream Missouri River dams. (Barges are loaded to a 6½ ft draft to Kansas City, 6 ft to Omaha.) Water is run through the dams' turbines as it is kicked loose to keep towboats afloat on the lower Missouri. During the navigation season the outflow from Gavins Point Dam at Yankton, S. D., lowermost of the Missouri River dams, runs from 28,000 to 30,000 cfs. In the winter period, the dam's release is reduced to around 9,000 cfs.

The exchange arrangement ties these two sets of circumstances together and puts them to constructive use. During the navigation season, excess power from the dams is given to OPPD. During the winter period, when South Dakota needs are at their maximum, OPPD will repay the power by excess capacity from its thermal plants. Payment will be in kind; no money will change hands.

At the rate of from 40,000 to 63,000 kw, OPPD currently is drawing about a million kwhr daily under the exchange arrangement. Expectation is that it will receive 50 million kwhr of exchange power in all during the rest of the navigation season which, because of a short water supply this year (14 million acre-ft inflow as compared with an average of 24 million), will be cut off Oct. 8—five weeks earlier than in 1960. The exchange power is in addition to 65 million kwhr of summer firm power from the Missouri River dams.

C. F. Moulton, the general manager of OPPD, said both participants will benefit mutually. OPPD is spared putting its older and less efficient generators on the line to handle the summer load, thus bringing about a money saving. The upstream area will benefit because it is assured winter firm power, he said.

Affects Power vs Navigation

The arrangement also has a tie on the power vs navigation dispute that has caused friction between the upper and lower portions of the basin.

The upper basin, beyond the reach of navigation but with a big stake in power, wants power production from the dams stepped up, particularly in the winter. The lower basin, which gets scant power benefits and with a primary interest in navigation, wants a full navigation season. Since there isn't enough Missouri River water to satisfy both participants to the full extent of their desires, either arrangement would be at the expense of the other.

Both sides claim backing in law. The dispute is now awaiting an opinion by Attorney General Robert Kennedy.

While the exchange arrangement is unlikely to resolve the basic dispute, observers said, it is looked upon to further the basic idea of the Missouri Basin program. That is to share the benefits of the multiple use program so that the greatest good comes to the greatest number of basin residents.

British Plan 700-Kv Transmission

J. H. M. SYKES, Overseas Engineering Correspondent, London

Over 2,000 leading British electrical engineers at the thirteenth British Electrical Power Convention heard Sir Christopher Hinton, chairman of the Central Electricity Generating Board, say that 700-kv transmission would be the next step in Britain, in about 12 years' time. The 700-kv system would take the form of a large mesh network superimposed on the 400-kv system now being built, and 275 kv would gradually disappear.

Transmission now takes priority, Hinton said. The sources of power are secure, although economic balances between conventional and nuclear power production remain uneasy. And the success of the 29,000-Mw British grid organization has been due entirely to the strength of the transmission system.

Yet the basic problem facing the supply industry is to find more rights-of-way. "I do not believe," said Hinton, "that the British public will tolerate an indefinite extension of the present transmission and distribution network giving, as it does in extending areas of the countryside, an effect rightly described as a wirescape."

Possible solutions to the problem of enabling a relatively small number of large power plants, strategically situated on the coalfields, to feed the area of demand were:

- To change to a higher voltage, from 275 kv to 400 kv and later 700 kv, to enable more power to be carried over fewer routes.
- To go underground. Here Hinton gave a cost ratio of 24 to 1 for the heaviest-duty, 2,200-Mva circuit, twin-circuit 400-kv lines, tapering to 8 to 1 for a 125-Mva, 132-kv circuit. "Get these figures down to about 5 to 1 and I'll buy underground cables," he said, "but I want the cost to relate to cables laid and terminated, not just the cable."
- To build ten to 12 250-Mw stations a year, located so as to ease transmission problems. This solution in Britain is impossible, since the number of power plant sites is limited.
- Reduce the over-all impact of overhead lines on the countryside by persuading Area Electricity Boards (the Agencies who take over power from the CEGB and distribute and sell it) to underground their 33-kv, 11-kv and 6.6-kv networks as far as possible.

In the discussions, cable makers said that while they did not hold out any hope of bringing the cost of undergrounding down to 5 to 1 in the near future, nevertheless the development of very large conductor sizes, up to 4 sq in., would prove a step in that direction. In addition, comparisons were not at present based on winter ratings of cables. This could cut cost ratios by 12%.

F. J. Lane, former deputy chief engineer for transmission of the CEGB, now one of Britain's leading consulting engineers, said that the step to 400 kv seemed to him not to look far enough ahead.

In 1950, 275 kv was adopted for reasons relating to considerations which were of a more or less temporary nature: lack of research effort and experience in higher voltages were among them. This voltage level had only lasted about ten years, he pointed out.

It would be more adventurous to go straight to 600 kv or 700 kv now, and a properly planned change, over four or five years, would readjust the system so that it would last for very many years.

Lane also suggested a closer look at the possibility of dividing the country into three or four self-contained areas, linked by direct current, nonsynchronous ties. This would perhaps ease the transmission problem. Again, he thought there should be re-thinking about the degree of safety built in to Britain's power system. To ensure security of supply, normally every feed was at least duplicated, and Lane thought that about 30% of total transmission cost and capacity was attributable to security reasons.

In another paper at the convention, S. F. Steward, director of the British Electrical and Allied Manufacturers' Assn, hit out strongly at the uncertainty about future British power plant programs that bedevilled the manufacturing industry in Britain. The current official view, given to the government by the Electricity Council and accepted by it as a regulator of capital expenditure, was that there would be some decline in the 6.9% annual increase in electricity consumption. Recent years had shown a reverse trend towards an increasing rate of rise. The security of supply was endangered by too narrow a margin between plant ordered and plant actually needed.

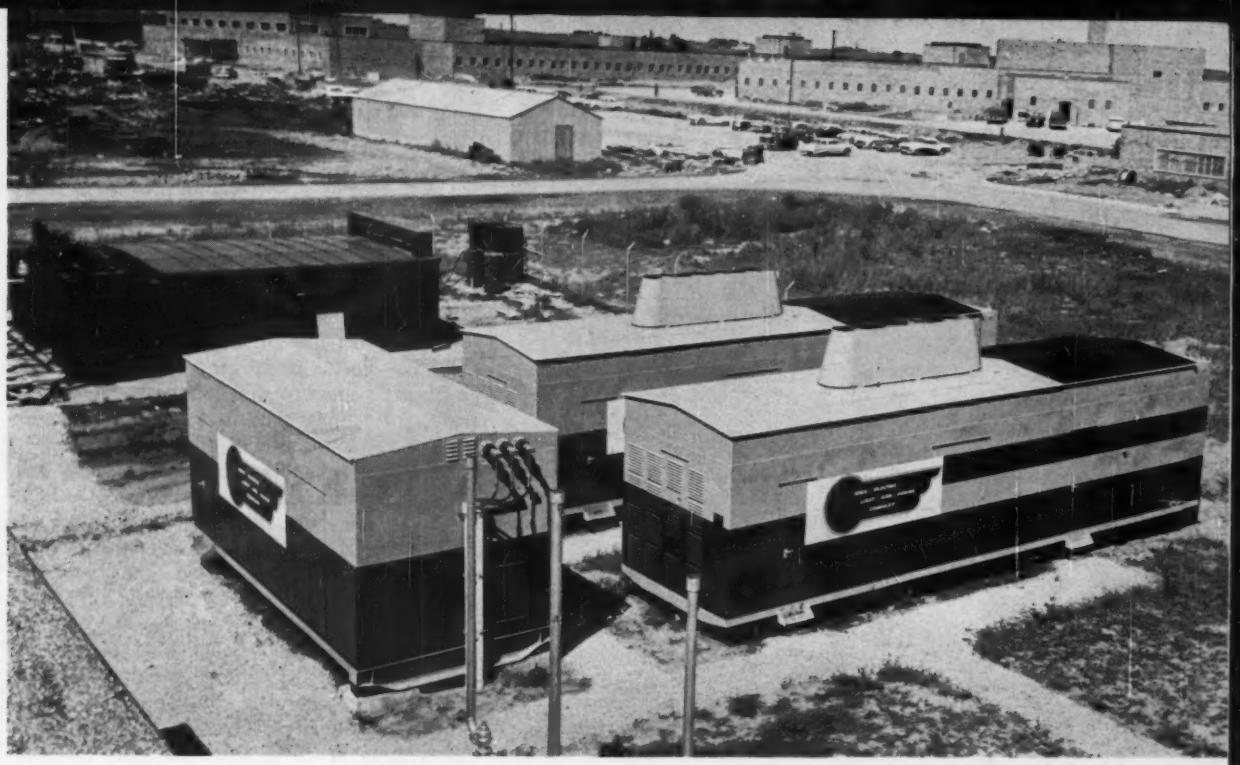
New FAA Rule Affects Tower Height

The Federal Aviation Agency has issued a new regulation spelling out when sponsors of new construction must file notice of plans to erect tall structures that might pose hazards to air navigation. The regulation, under consideration since last fall, will become effective July 15.

It requires a minimum of 30 days' notice when a new structure or alteration to an existing structure (including buildings, power lines, radio or TV towers) is planned in excess of certain heights. In general, notice will be required for structures anywhere which are to be higher than 150 ft and for structures of lesser heights near an airport or in a landing approach area.

Where FAA determines a hazard will exist, it will seek an amicable settlement. It will consider re-routing airways around or above such structures, and where this is not feasible, will seek to persuade the builder to alter his plans to eliminate the hazardous portion of the structure. Where no agreement can be reached, the courts will decide.

Copies of the new regulation may be obtained from FAA regional offices or from the agency's headquarters, 1711 New York Ave, NW, Washington, D. C.



Diesel Fulfills Dual Need

Assurance of continuity of service and daily peak-shaving operation are provided by an automatic 2,000-kw plant

HERBERT HENDERSON, Vice President, Engineering, Iowa Electric Light & Power Co, Cedar Rapids, Iowa

The rendering of "special" service and provision of peaking capability are the twin functions of a dual-fuel 2,000-kw diesel generating unit being operated by Iowa Electric Light & Power Co on the grounds of the National Animal Disease Research Laboratory just outside Ames, Iowa. This totally-automatic remote-controlled plant is designed to:

1. Insure absolute continuity of electric service.
2. Provide capacity for an average of 15 hr per day to the system in the Ames area.
3. Defer future substation construction.
4. Reduce the cost of transmission to the laboratory site.

This 2,000-kw Electro-Motive diesel peaking plant is noteworthy even on the system of Iowa EL&P, which has been using diesel peak-shaving plants successfully for five years and has 370,000 kw of generating capacity. These circumstances dictated the use of the new dual-fuel diesel peaking plant.

The US Dept of Agriculture's $17-million research laboratory near Ames requires an absolutely constant supply of electric power, natural gas and fuel oil. Because the Iowa EL&P system already has 15% of its total capacity in peak generation, any additional peaking capacity near Ames would aid service in the area if, at the same time, the installation could provide the absolute continuity of service required by the laboratory.

While new transmission lines could be built from the Nevada Substation and power could be provided from that location, construction costs were high. More importantly, however, even with double 34.5-kv loops to the laboratory through either Boone or Nevada Substations, electrical power could not be guaranteed to the new government facility. One errant Iowa tornado could easily destroy ten or 20 years of research effort at the laboratory unless electric service is assured at all times, under every condition.

Consequently, there was no substitute for putting generating equipment right on the spot to insure against outages. The problem was to find equipment that could do the job. For a small capital investment, the automatic, dual-fuel diesel peaking plant was the answer.

Iowa EL&P has contracted with the government to provide the laboratory with 4,000 kw at 80% power factor. Normally, service is provided through the 34.5-kv south line from Nevada. The peaking plant will provide ample power for the lab's 1,700-kw preferred load in case of emergency. As an area peak shaver under normal conditions, it will carry some of the laboratory load ranging from a winter-time norm of 2,700 kw to a summer-time maximum of 4,400 kw.

The 2,000-kw peaking plant at the laboratory site also led to another economy. A new substation

would be required at the site to step down the 34.5-kv loops either from Boone or Nevada. The diesel plant allows the company to utilize one substation both ways: Step down to lab voltage from 34.5 kv and back to 34.5 kv when the diesel plant is in peaking operation.

From an operating standpoint, the company can run a diesel plant on fuel oil for a few hours more economically than steam. For generation up to 15 hr a day, the use of natural gas in the dual-fuel diesel peaking plant still is an economical procedure. The unit normally is operated from 7 am to 10 pm at least five days a week. Further, the Ames plant can be enlarged from 2,000 kw to 5,000 kw dual-fuel capacity if needed. The plant also can be increased to 8,000 kw by a combination of dual-fuel plus straight diesel operation.

The plant consists of two generating units and one control station, individually housed, which provide 2,000 kw, 3-phase, 60-cycle, 4,-160-v generation. The diesels operate on 94% natural gas with 6% pilot ignition oil and have fully automatic synchronizing and loading controls. The plant utilizes an EMD 1,250-kva alternator and a static-type magnetic amplifier exciter. The fuel, lubricating oil and closed engine cooling systems are complete within the units. A 15-kw immersion heater, thermostatically controlled, utilizing bus power and complete with lubricating oil and engine water circulating pumps, assures all-weather operation.

The control station includes generator control, switchgear, automatic synchronizing and loading controls, starting battery and charger and power take-off connections. It has two sets of dead-front, metal-clad switchgear with provision for third or fourth sets. A single set of metering equipment may be assigned to either the bus or each of the two power units by a kw switch.

Complete Protection Included

The generators are protected against external faults by voltage restrained overcurrent relays and against internal faults by a combined bus and generator differential relay arrangement. Protection also is provided against generator overvoltage, overcurrent, field failure and reverse power. A heavy-duty 120-v 177 amp-hr battery for cranking, and a saturable reactor type battery charger are supplied with the plant. A 3-phase auxiliary power transformer steps down power from the load side of the circuit breaker; surge capacitors and lightning arrestors also are provided.

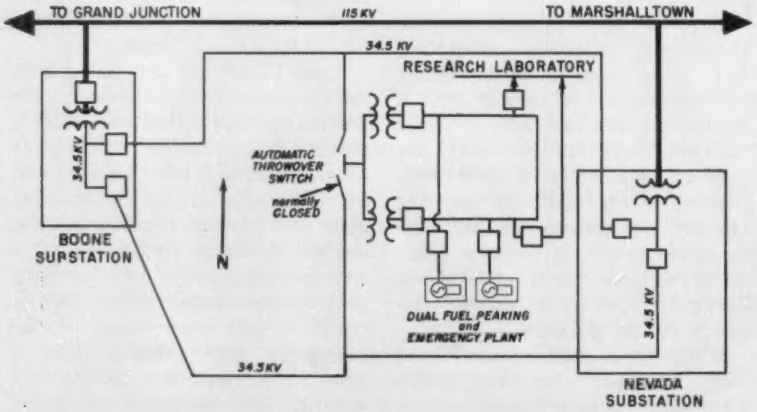
The plant's automatic control system, on receipt of a local or remote starting signal, will start, synchronize, and load the individual generating units in sequence. The Ames plant will be operated as a peak shaver by remote-control signal from Boone, 20 miles distant, but the plant is totally automatic in emergency service. Here is the sequencing that occurs automatically, without a signal or control from any operator, should we have an emergency in connection with the government laboratory:

If an outage occurs on the 34.5-kv south line from Nevada (which normally feeds the laboratory site), an automatic throwover switch transfers to the north line. If the north line fails to hold, an automatic system signal activates a 30-sec waiting cycle in the peaking plant. After the half-minute, the engines start automatically and come to full speed immediately. If both high lines are out, a second automatic system signal closes the breakers and the units take the preferred load. Following the first indication of an outage, if either of the 34.5-kv lines hold, the peaking plant continues to run at full speed for 3 min before shutting down automatically.

When the high lines are restored following an outage, the diesel plant automatically re-synchronizes under load with the system, then converts itself back to a peaking operation and runs until shut off by remote control signal from Boone. No operator signal is needed during the dead-load sequence; however, a leased-line pulsed signal from Boone is used to put the diesel plant into normal peaking service.

Being a dual-fuel unit, the plant automatically switches to straight diesel fuel operation in case of low, or loss of, natural gas pressure. Following return to normal gas pressure, the unit returns to dual-fuel operation. Whenever the emergency dead-load sequencing is activated, the peaking plant automatically switches to straight diesel fuel operation, and returns to dual-fuel only when normal service has been restored.

These capabilities are especially important since they give total reliability of generating capacity under all circumstances, including simultaneous loss of electric power and natural gas supplies. To assure the plant's emergency dead-load capability, it will be performance-checked on a regular basis, probably every three months. Iowa EL&P engineers have developed methods of blocking relays to simulate an outage to test the dead-load operation.



NORMAL SUPPLY to a research laboratory at Ames, Iowa, will be the south 34.5-kv line. The diesel plant will assume the laboratory "preferred" load automatically upon loss of the south and north 34.5-kv lines. The plant normally runs 15 hr daily on week days to carry peaks

Power Plant Auxiliaries Get Better Protection

High resistance grounding costs approximately the same as the solidly grounded system, eliminates transient overvoltages of ungrounded system and has lower maintenance cost

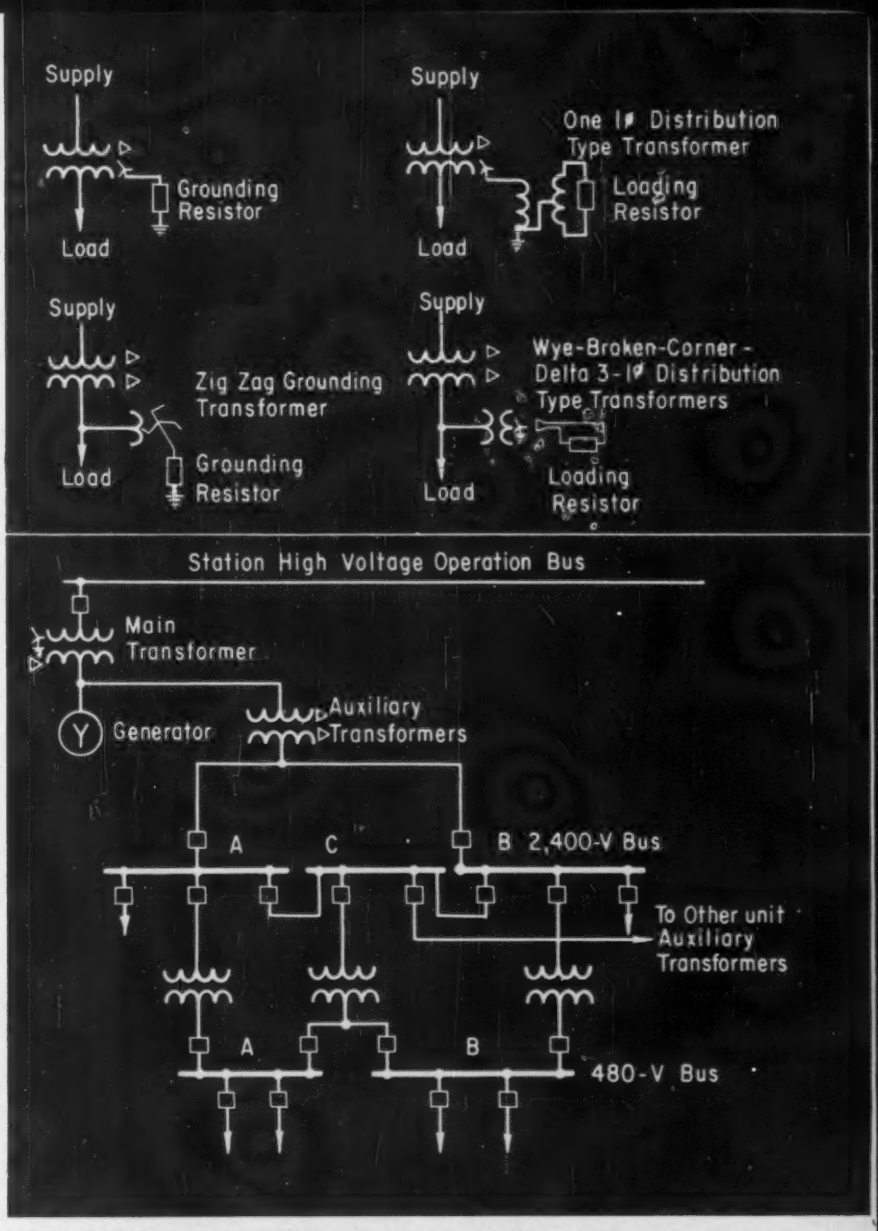


FIG 1—**GROUNDING RESISTORS** added by any of the four methods shown to an otherwise ungrounded auxiliary system provides the advantages of high-resistance grounding for improved protection against faults

C. W. COGBURN, Section Head-Relays, Engineering Dept, Florida Power & Light Co, Miami, Fla.

High resistance grounding has been adopted by Florida Power & Light Co for the auxiliary buses of recent and proposed generating units to minimize forced outages from failure of essential auxiliary circuits. The new arrangement offers such advantages as simplicity, minimized overvoltages, limited line-to-ground fault current, and selective tripping. Protection of plant motors is compromised to maximize service continuity for the generator.

High resistance grounding was first applied on the 240-Mw unit placed in service last year, after analysis of ungrounded-delta auxiliary systems used since 1957 on four 165-Mw units disclosed difficulty in achieving the desired protection. Sensitive residual current relaying was applied to these ungrounded delta systems, Fig 2, set at 15% of motor full-load current. This arrangement provides no protection for the first ground that occurs on the system, but clears fast when a second ground occurs on another phase of an adjacent circuit, setting up fault-current path shown by the dashed line.

The current system has some merit, but a thorough study is necessary to insure correct relaying for all situations. For example, if a ground occurs on phase 2 of auxiliary feeder A and on phase 1 of auxiliary feeder B, these faults appear to tie circuits X and Y as phase-to-phase faults and clearing will be very fast with a sensitive setting on

relay 5IN. Moreover, an open or grounded CT at location W may put false residual current in the coil of relay 5IN to cause an unnecessary operation on tie circuit X.

The possibility of such unnecessary operations has been eliminated by removing residual relays 5IN and adding a third phase relay to tie circuits X and Y.

Cost Is Reasonable

The high-resistance-grounded auxiliary system has been found only slightly more costly than earlier ungrounded systems and less expensive to install than the low-resistance-grounded system. It has been specified for a new 240-Mw unit scheduled for operation this year as well as for the 300-Mw units going in service in 1962 and 1963. The grounding resistor for these applications has a rating nearly equal to but not greater than the zero-phase sequence capacitance of the system. It is applied to the auxiliary bus as shown in Fig 1, selecting whichever of the four possible methods is found most applicable.

With this arrangement, overvoltages are minimized and line-to-ground faults are limited to about 8 amp or less so that melting or fusing of iron laminations in motors cannot occur. Faults are being annunciated, not tripped, on these installations.

For protection purposes, auxiliary motors are divided into two classes: essential and non-essential. Fuel, condensate, boiler-feed, and condenser-cooling-water pump motors are classified as essential. Motors that, if interrupted, would not shut the unit down are classified as non-essential.

Essential motors of 100 to 3,500 hp are served from a 2,400-v or a 4,160-v bus. Less essential or smaller motors are served from a 480-v bus which is supplied through a step-down transformer from the main auxiliary bus.

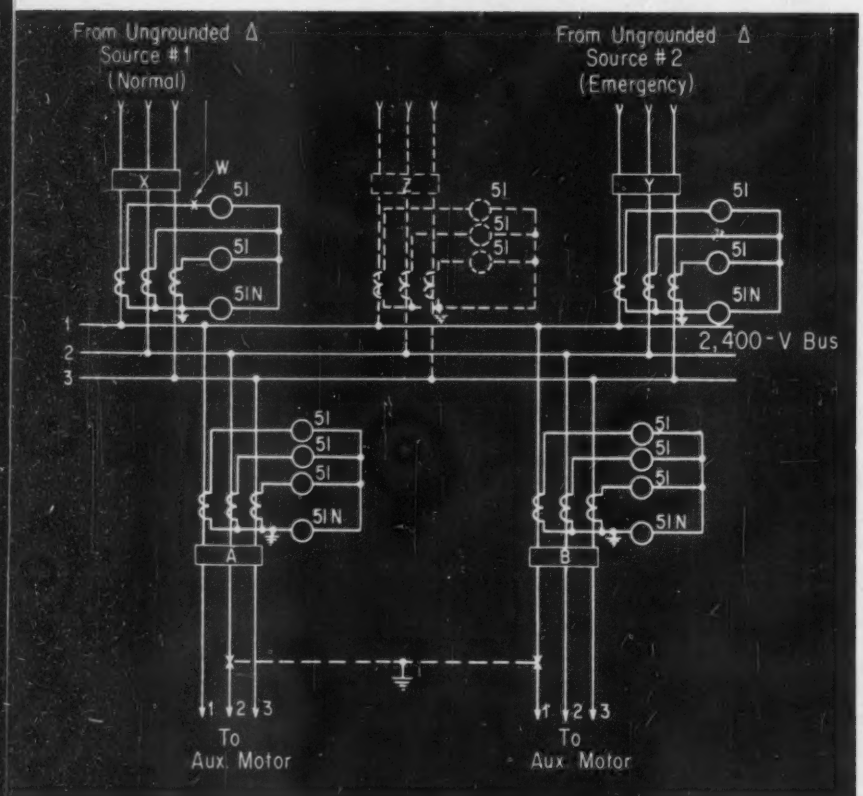


FIG 2—FAULT STUDY of earlier ungrounded system used for four recent 165-Mw units revealed shortcomings of sensitive residual-current relaying scheme

All essential motors are equipped with three overcurrent time-delay relays with instantaneous attachments for:

1. Stalled rotor protection.
2. Short circuit protection.
3. Overload annunciation.

Short circuit protection is provided by three instantaneous attachments set at 200% of locked-rotor current to detect minimum fault current and yet not trip on the maximum asymmetrical current the motor can supply to a fault elsewhere.

Relays Trip Stalled Motors

Overcurrent relays are set at 200-300% of full-load current for stalled-rotor protection with time delay to override starting current. The third overcurrent relay is a replica type set at 115-125% of full load with sufficient time delay to override the starting current; this relay provides overload annunciation.

Undervoltage protection is not provided as the motors must operate during system overload conditions.

No single-phasing protection is provided as open-circuit conditions are rarely experienced on power plant auxiliary systems.

Supply circuits have three overcurrent time delay relays in each phase for tripping duty. Instantaneous relays are omitted because coordination with the instantaneous settings on other circuits is not practical for phase-to-phase fault currents approaching maximum inrush levels.

The high-resistance-grounded system, like the ungrounded system, cannot segregate the first line-to-ground fault automatically. But automatic segregation occurs on two feeders when a second line-to-ground fault occurs on an opposite phase of the second feeder. All other types of faults, such as three-phase, phase-to-phase and two-phase-to-ground, are segregated automatically.

A ground detecting relay in the high-resistance-grounded system annunciates the first ground so it can be cleared before the second ground occurs. The grounded conductor is not located automatically. But several methods, including an audio tone system, hook-up ammeters, and pulsed currents, have been developed for locating the grounded conductor.

Slide Chart Aids in Paralleling Transformers

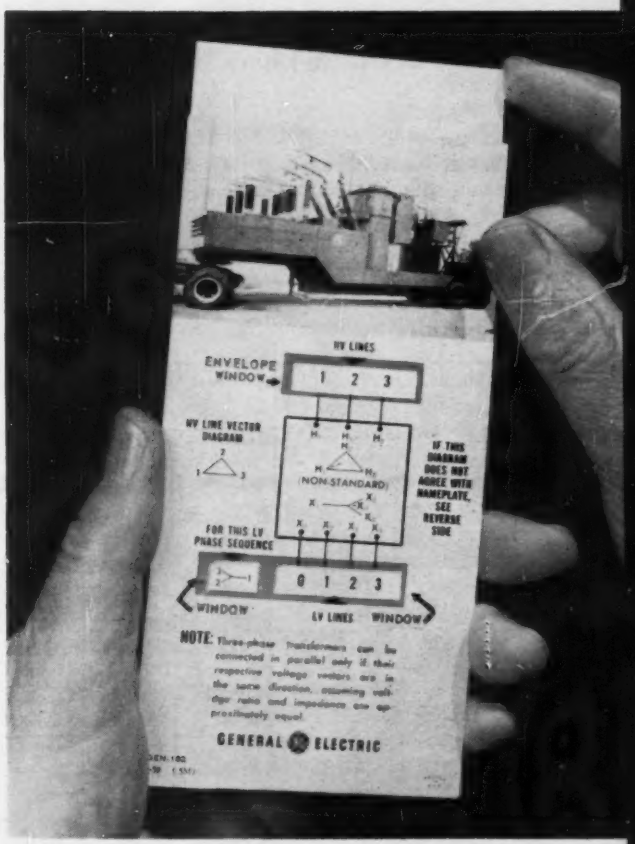
WAYNE POLSLEY, Supervising Engineer-Substation, Indiana & Michigan Electric Co, Marion, Ind.—AEP System

A simple slide chart, developed at Indiana & Michigan Electric Co, permits a quick determination of connections required for paralleling a NEMA standard transformer or a transformer with non-standard windings. Furthermore, use of the device cuts the labor involved in phasing-in the transformer and can achieve a significant reduction in customer outage time.

When installing or paralleling 3-phase delta-wye transformers, and particularly when placing mobile stations in service, this phase-finder slide chart aids in quickly determining the proper arrangement for incoming and outgoing lines. By finding the connection arrangement requiring the least amount of line changes and by avoiding subsequent changes usually required after voltage checks are made, considerable time is saved. Once tests verify the phasing sequence selected, the transformers can be paralleled without delay. Before using this chart we had cases of considerable delay and lost time in finding the proper line arrangement by trial-and-error phasing out procedures.

This phase-finder chart has an inner slide containing information to match the windows on both sides of the envelope. One side is used for a NEMA standard transformer winding. The other side of the phase-finder chart is used for a non-standard transformer winding. To use this slide chart, first determine which side of the chart to use by comparing the transformer diagram shown on either side of the chart with the nameplate of the unit that is to be connected for service. Position the card in or out until the proper line arrangement and angular displacement appears in the envelope windows. There are three different line arrangements for every paralleling situation, and the one that best fits the existing line arrangement can be selected, i.e., the one that requires a minimum amount of line changes. This chart does not take the place of electrical phase tests to be made before actually connecting a transformer in parallel. But with a little practice in using the slide chart, all of the possible proper connections can be determined. The one most nearly matching the existing physical arrangements can be selected, connected, tested, and placed in service in a minimum amount of time.

During emergency transformer installations or paralleling, saving time is very important from the standpoint of reducing customer outage time and, in all cases, saving labor. The use of this phase finder has speeded up the installation of our mobile unit during emergency conditions. It has also been helpful in the paralleling of transformer banks. During the first 14 months of using the chart in Marion-Muncie Division, our portable stations had to be connected 21 times. The first attempt at phasing was correct in all but one case, where the phase identification at this station had not been well marked. It is impossible to estimate how much time would have been lost and how many additional trials would have been needed under previous procedures.



PROCEDURE is clearly outlined on the slide chart; reverse side applies to non-standard transformer windings

Part 1—Small Computer Is Versatile

Calectric finds that engineering applications for desk-size machine are limited only by imagination of engineers

A. J. MISCHNICK, Supervising Engineer, Computer, California Electric Power Co, San Bernardino, Calif.

With the advent of relatively low-cost "desk-size" digital computers, a utility can justify the use of such a tool just for complex engineering and operating problems. Anyone who has studied these problems knows the multitude of conditions that must be considered before a clear-cut, sound solution can be obtained. And many of these problems are just as complex for small or medium sized utilities as they are for large ones.

If a company is large enough to employ a staff to coordinate the use of a large computer and apportion its time among several departments, this is certainly the type of operation to use—but, unfortunately, this is not the case with many utilities. At California Electric Power Co, the accounting department has a machine accounting section with data processing machines adapted to its needs, but these machines are not suitable for engineering calculations. An accounting department study showed that a larger computer that would handle both requirements was not justified.

A general purpose, stored program type digital computer was thus purchased solely for engineering computations. The unit, a Royal McBee LGP-30, has a magnetic drum memory of 4,096 words, 32 binary bits in length plus sign and spacer bits—approximately equivalent to a nine-decimal digit number.

The basic machine uses an electric typewriter as the input-output device. It has a paper tape reader and punch unit that operates at the electric typewriter speed of 10 characters per sec. A 200 character per sec paper tape photo-reader is available as optional equipment, and it may be obtained with a 20 character per sec paper tape punch unit.

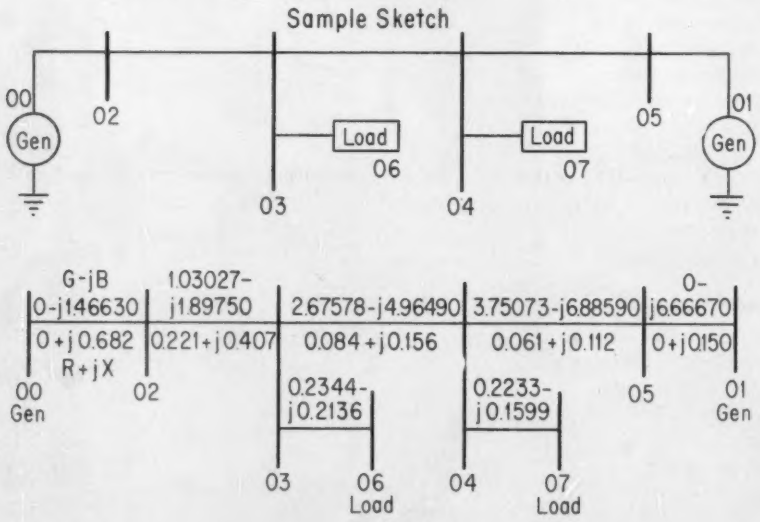
Exclusive of typewriter and shelf, the machine is 26 in. deep, 33 in. high, and 44 in. long. It weighs 800 lb and is mounted on casters for portability. Full operation power is 1,500 w at 115 v. No special structure or air conditioning is needed.

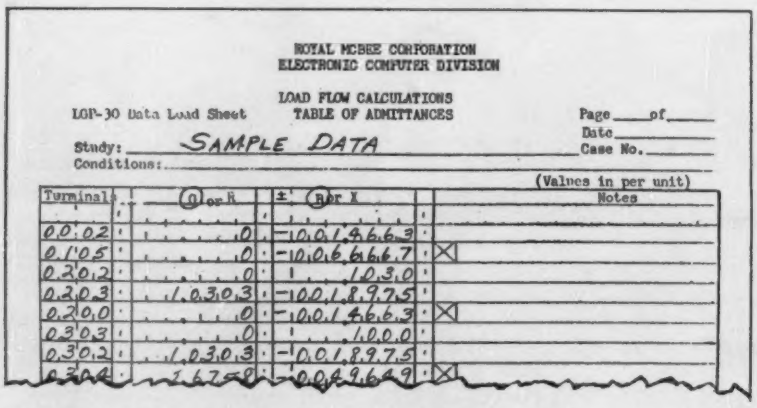
In 1958, studying applications which might justify purchase of the unit, Calectric engineers estimated that it would be used for 20% of the available normal 8-hr shift time for the first year. This was found to be amazingly low—actual computer time run for the first complete year of operation was above 95%, a figure higher than the originally estimated machine availability.

Two other factors instrumental in justifying the computer were:

- The ability to solve problems more thoroughly. Problems that were previously bracketed are now solved for intermediate conditions. Human errors are materially reduced.
- The ability to attack and solve new problems that were not feasible by manual methods. Many applications appear after the machine approach to problems has been made.

Before delivery of the computer, two engineers attended a programming class which is conducted periodically by the manufacturer. Two other engineers have since been to the class and another engineer has learned by programming some




ROYAL MCBEE CORPORATION
ELECTRONIC COMPUTER DIVISION

LOAD FLOW CALCULATIONS
LGP-30 Data Load Sheet TABLE OF ADMITTANCES

Page ____ of ____
Date
Study: SAMPLE DATA Case No.
Conditions:

(Values in per unit)

Terminals	G or R	± B or X	Notes
0,0 0,2	.0	-10.0,1,4,6,6,3	
0,1 0,5	.0	-10.0,6,6,6,6,7	X
0,2 0,2	.0	1 .0,3,0	
0,2 0,3	1.0,3,0,3	-10.0,1,8,9,7,5	
0,2 0,0	.0	-10.0,1,4,6,6,3	X
0,3 0,3	.0	1 .0,0,0	
0,3 0,2	1.0,3,0,3	-10.0,1,8,9,7,5	
0,3 0,0	1.6,7,5,0	-10.0,4,9,6,4,9	X

SAMPLE PROBLEM and data for load flow studies are written for iteration techniques. Admittance data are found from Generate Admittances Program

Engineering Tool

of his own work. The only other Calectric engineers who have done any direct computer work are a few who have written compiler programs under the guidance of a programmer-engineer.

This does not mean that engineers with computer projects are divorced from the machine. They follow projects closely and get an appreciation of the machine's limitations as well as its versatility.

A four-program package for the LGP-30 demonstrates the usefulness of a small computer in utility engineering work:

1. The Generate Table of Admittances Program calculates and stores a system admittance matrix in proper memory location of the main Load Flow Program, reading either system impedances or admittances. The program then punches out, for future use, a paper tape containing the system matrix. A system with a maximum of 100 buses and 270 lines may be studied.

2. The Load Ffow Program, written for iteration techniques, has proved convenient because of the flexibility of entering and altering system data and the simple, complete and compact print-out of results.

3. The third program, to calculate driving point and transfer admittances for direct entry into the fourth program, uses the same system matrix as the Load Flow Program and operates comparably. The output is a complete punched tape of driving point and transfer admittances for the system that can be entered directly as data into the Transient Stability Program. A maximum of 100 buses with 270 lines can be handled.

4. The Transient Stability Program calculates the necessary data for plotting power system swing curves. The data are the results of the point-by-point method (Euler's Method) of solving swing equations.

The computer also handles such studies as loss of load probability in analysis of generation scheduling, production cost determination, overhead distribution voltage drops and losses for primaries, and power transformer heat run calculations.

The function of the load loss of probability studies is to provide a table of cumulative probabilities of capacity (generator or interconnection) outage. The program develops a sorted per-unit weekday peak demand pattern, incorporates an overhaul schedule and computes a probability of loss of load as a function of annual peak demand. Complete input, control and computation, and output functions are included.

As system load varies, the principles of economic dispatch normally dictate the need to vary allocation of generation in the proper sequence of generation incremental costs. When transmission losses are considered, penalty factors are applied to bus bar incremental cost to obtain incremental cost of delivered power. Using a load duration curve the production cost determination program solves for the appropriate generation allocation to meet kwhr requirements while minimizing over-all cost.

A complex arithmetic analysis of distribution radial circuits handles a maximum of 127 load stations, either transformers or capacitors, along each radial line. Input requirements are circuit nominal voltage, circuit demand factor, circuit annual load factor, circuit uncorrected power factor, source per-unit voltage, summation resistance, summation reactance, station numbers, distance between stations in feet, circuit conductor size between stations, phase of circuit between stations and station transformer and/or capacitor kva. The program prints station numbers, distance between stations, station connected kva (transformers or capacitors), percent voltage drop from source, kw loss from source, annual kwhr loss from source, circuit kvar demand between stations, and summation R and X to each station.

A flexible program for calculating power transformer heat runs by means of selective coding has been compiled. The program "turns on" fans at some selected "on" temperatures and "turns off" fans when the temperature drops to a selected "fans off" level.

Several programs need specific curve data as input information.

ELECTRIC TYPEWRITER is used as basic input-output device. It has a paper tape reader and punch unit that operates at 10 characters per sec

By using curve fitting programs obtained as standard programs from the computer manufacturer, equations for these curves have been entered and curve values calculated as a part of the program. Computations for the reduction of steam unit performance test data to heat rates and efficiencies is a typical example.

When Calectric began to apply the computer to manual problems some replanning was necessary. A single program avoided duplication of work among departments. Problems would be carried through in some cases without redundant logging of final or intermediate results. Computers were found to be more efficient than trained personnel.

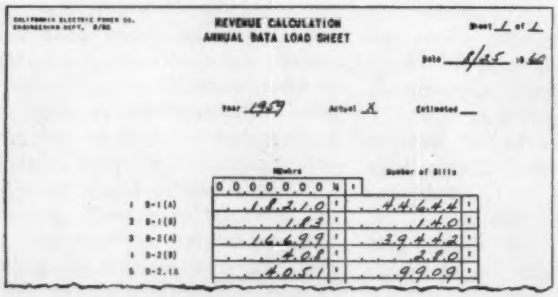
A small general purpose computer is a good machine for gaining experience in computer applications and techniques. Program techniques used on one computer can be very valuable when programming another. Even more important, however, are the methods of solution and solutions of problems that simply are not recognized until computer techniques are used. The application of a digital computer to utility problems is then seen to be limited essentially only by the resourcefulness of utility engineers. One of the engineering problems simplified by the computer is that of calculating revenue from proposed rate changes. Another Calectric engineer presents on the next two pages the solution developed for work in this engineering area.

Part 2—Computer Approach Speeds

Mathematical model represents rate spread; computer evaluation of alternatives prevents rate case delays

A. D. BALDWIN, Asst Rate Engineer, California Electric Power Co, San Bernardino, Calif.

Prior to and during rate proceedings, utilities are under great pressure to calculate very rapidly the effect of proposed rate schedules on revenue, and conventional methods are often too slow. California Electric Power Co has devised a computer program which speeds this process, avoiding the possibility of delays in rate decisions because of revenue-effect calculations. With the new program it is possible to take revenue calculations directly from the computer in printed form only minutes after the proposed rate changes have been presented to the computer.


REVENUE CALCULATION
ANNUAL DATA LOAD SHEET

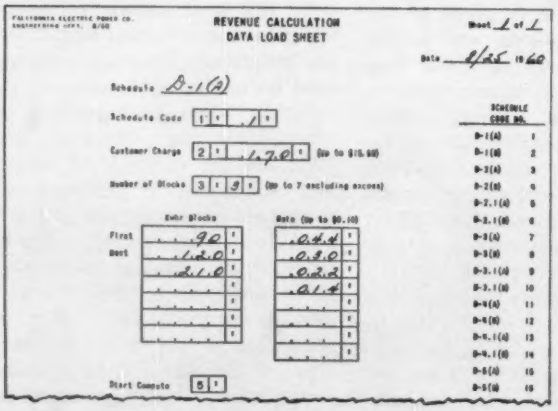
Sheet 1 of 1

Date 1/25 19 60

Year 1959 Actual X Estimated ___

		Kwhrs	Number of Bills
1	D-1(A)	1,821,0	44,644
2	D-1(B)	183	140
3	D-2(A)	16,699	39,442
4	D-2(B)	401	280
5	D-2.1A	40,511	9,909

REVENUE CALCULATION ANNUAL LOAD DATA SHEET lists kwhr sales and bills rendered in either actual or estimated test year. Data are used to adjust mathematical model in program to test year for which calculation is desired. Data are fed to computer by punched tape


REVENUE CALCULATION
DATA LOAD SHEET

Sheet 1 of 1

Date 1/25 19 60

Schedule D-1(A)

Schedule Code 1 , 1

Customer Charge 2 1.70 (Up to $15.00)

Number of Blocks 3 3 (Up to 7 excluding excess)

	Kwhr Blocks	Rate (Up to $0.10)
First	90	.044
Next	120	.040
	210	.022
		.014

Start Console 5

SCHEDULE CODE NO.	
D-1(A)	1
D-1(B)	2
D-2(A)	3
D-2(B)	4
D-2.1(A)	5
D-2.1(B)	6
D-3(A)	7
D-3(B)	8
D-3.1(A)	9
D-3.1(B)	10
D-4(A)	11
D-4(B)	12
D-4.1(A)	13
D-4.1(B)	14
D-5(A)	15
D-5(B)	16

REVENUE CALCULATION DATA LOAD SHEET contains proposed rate schedules. Any number of alternate arrangements can be applied to the schedule. Typically, several alternatives would be punched into one tape input to the computer for a computation session

The heart of the program is the representation of rate spreads in the form of an equation or mathematical model. Parameters of the equation representing each rate schedule are stored in the program. Revenue is calculated by applying the proposed rate schedule to the appropriate mathematical model.

The computer evaluates the mathematical model for each rate block and thus determines kwhr sales within each block. It then multiplies the appropriate rate for each block by the kwhr sales within each block and in turn totals the revenue derived from the sale of kwhr in each block. The computer then determines revenue derived from the customer charge, adding this to the above total revenue and prints out results.

The mathematical model of each rate spread has been determined by a least squares curve fit applied to a statement of kwhr sold in each block, which has been accumulated into an ogive curve (accumulative frequency distribution). A sample of this curve is shown, in which the annual kwhr sales shown on the Y-axis have been converted from absolute to percent of total. Furthermore, the kwhr blocks shown on the X-axis have been expressed in terms of per unit of average kwhr sold per bill. It is then possible to obtain a data point for each kwhr block for each month, which results in 36 data points for a 3-block rate. Three groups of data points represent the first 90, next 120, and next 33-kwhr blocks of the rate schedule. The ogive curve must be fit to these known data points to determine the entire locus of points. Once this fit had been made the curve can be used in three different ways.

- The curve can be read directly. In this case the accuracy of revenue calculation is limited to the accuracy with which the curve can be read.
- A table of kwhr distribution can be made from the equation of the curve fit. This provides greater accuracy than reading from the curve. However, if the table is made in small enough kwhr increments to be adaptable to all block sizes, it is long and too cumbersome for easy calculation.
- The formula to which the kwhr distribution data has been fit can be used to calculate revenue. This provides both accuracy and a continuous expression of kwhr distribution, permitting accurate revenue calculations under all block size arrangements. However, any equation which accurately fits a rate spread is much too complex for manual curve fitting and certainly much too complex to be practical for manual calculation. Fortunately, complexity is no problem for an electronic computer, so application of an equation or mathematical model of a rate spread is a natural and logical way to make revenue calculations.

A least squares curve fit program, supplied by the computer manufacturer, was used. The equation which best fit the rate spread data was a 6th degree power polynominal of the form shown in the box by the curve. Approximately 45 min are required to make the curve fit for each rate spread.

It should not be necessary to make curve fits more often than every four or five years, because a rate

Rate Calculations

spread in the ogive form with the X-axis in per unit of average kwhr sold per bill retains its usefulness over a long period of time.

The usefulness is preserved because average kwhr sold per bill tends to change proportionally at all block sizes whether the change is due to load growth or seasonal changes. The effect is to cause the Y coordinates to slide up or down along the same locus of points as the average kwhr sold increases or decreases. This results in a rate spread which is resistant to load growth and seasonal changes.

The program in its present form is usable only on the Royal McBee LGP-30, although it could be adapted for other computers. The program calculates California Electric Power Co revenue for 16 domestic and eight commercial rate schedules of the customer charge and energy type. The test period can be either an actual or estimated year for which the total number of bills rendered and total annual kwhr sales are known or have been estimated for each rate schedule.

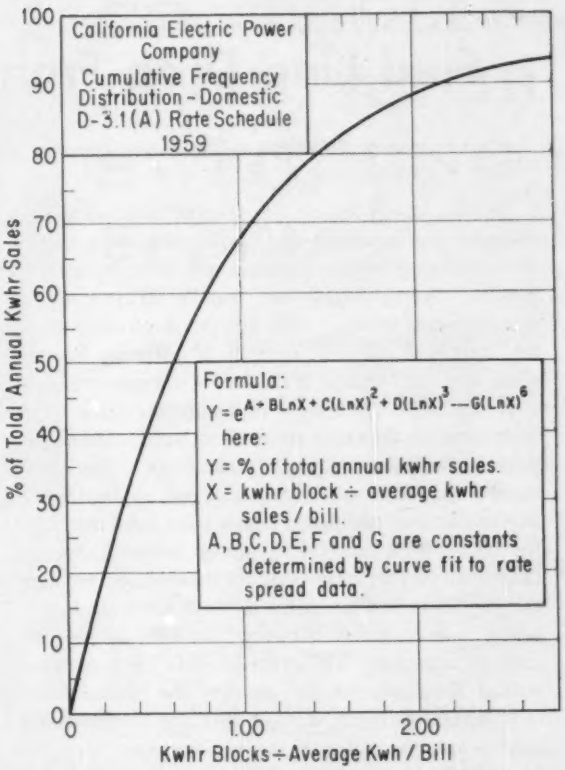
Steps Outlined

To use the program, the annual load data are first entered on the revenue calculation data load sheet. The annual data load sheet, which lists the kwhr sales and number of bills rendered in either an actual or estimated test year, is used to adjust the mathematical model in the program to the test year for which the revenue calculation is desired. Annual data are punched into tape for presentation to the computer prior to presenting proposed rate schedules to the computer. Typically, annual data tapes are kept on hand before revenue calculations are needed.

Next, proposed rate schedules are written on a revenue calculation data load sheet. Any arrangement of blocks and rates can be used within the limitations shown on the load sheet. Furthermore, any number of alternate arrangements can be applied to each schedule, provided each carries the appropriate code number in the schedule code block of the load sheet as taken from the schedule code number listed on the righthand side of the load sheet. Typically, several alternate proposed rate arrangements would be punched into the same tape for presentation to the computer during one computation session.

The proposed rate schedule tape is then placed in the computer's tape reader. The program is arranged to print the schedule designation and then read the proposed rate schedule data into the computer while simultaneously printing out the data being read. The printing of the data from the tape is incidental to the mechanics of the read-in process, but it does serve as a check against errors in punching and reading of the proposed rate schedule tape.

Finally, a compute code is read from the tape and signals the computer to start computation. Roughly ten seconds later, computation has been completed and the typewriter starts to print out results of the calculation for one rate schedule on print-out stock. Roughly one minute later, print-out of one complete rate schedule revenue calculation has been completed and the computer returns to start the cycle all over again for calculation of another rate schedule.



CUMULATIVE FREQUENCY DISTRIBUTION curve (ogive curve) expresses total monthly kwhr sales by blocks as percent of total on Y-axis, with rate schedule blocks as per unit of average kwhr sales per bill on X-axis. This permits direct reading of customer distribution between blocks

The accuracy of the revenue calculation depends on the precision of fit obtained in the curve fitting process and in turn on the depth and accuracy of statistical data available for the rate spread. In the case of this program, overall accuracy of the calculated revenue during the actual test period was 0.46%. Calculation of the revenue derived from the sample rate schedule yielded an accuracy of 0.08%. This was one of the better curve fits because it had good statistical depth encompassing 17.5% of the total California Electric Power Co residential revenue.

Accuracies such as these were not found in cases where the statistical depth of the rate spread data was small. An example of this is a rate schedule in which only 140 bills were rendered during the test year. In this case the calculated revenue was 2.93% above the actual revenue for the test period. This error is not serious as this schedule encompasses only 0.00042% of total residential revenue. Fortunately, it is possible to increase statistical depth by accumulating rate spread data for more than a 1-year period and thus increase accuracy.

Find Line Drop From Sending-End Voltage

J. B. **GMEINER**, Asst Manager, Electric Dept, Stone & Webster Service Corp, New York, N. Y.

Voltage drops based on percent of sending-end voltages and receiving-end loads are shown in the accompanying curves. These values differ from other popular charts, which are usually in percent of receiving-end voltage. The advantage of using sending voltage is obvious since it is normally known, while receiving voltage is the factor to be determined.

If sending-end voltages or conductor sizes other than those on the chart are needed, interpolation will provide the other required parameters. The chart here is for 90% power factor. For application in day-to-day use, additional charts have been prepared for 85%, 95% and 98% power factors. Similar charts can be prepared easily for distribution voltages ranging from 2.4 kv delta to 14.4 kv with kva-ft, which is usual for distribution planning, as the calculating constant. The exact formula for computing voltage drops was used to prepare the basic data.

If several different sizes of wire are involved in a calculation, the miles of the various wire sizes can be multiplied by constants determined from the graph to place all sections of the line on the same conductor-size basis. All of the equivalent Mw-miles of the various sections are then added together and read from one conductor size on the chart to give the total drop for the combined line sections.

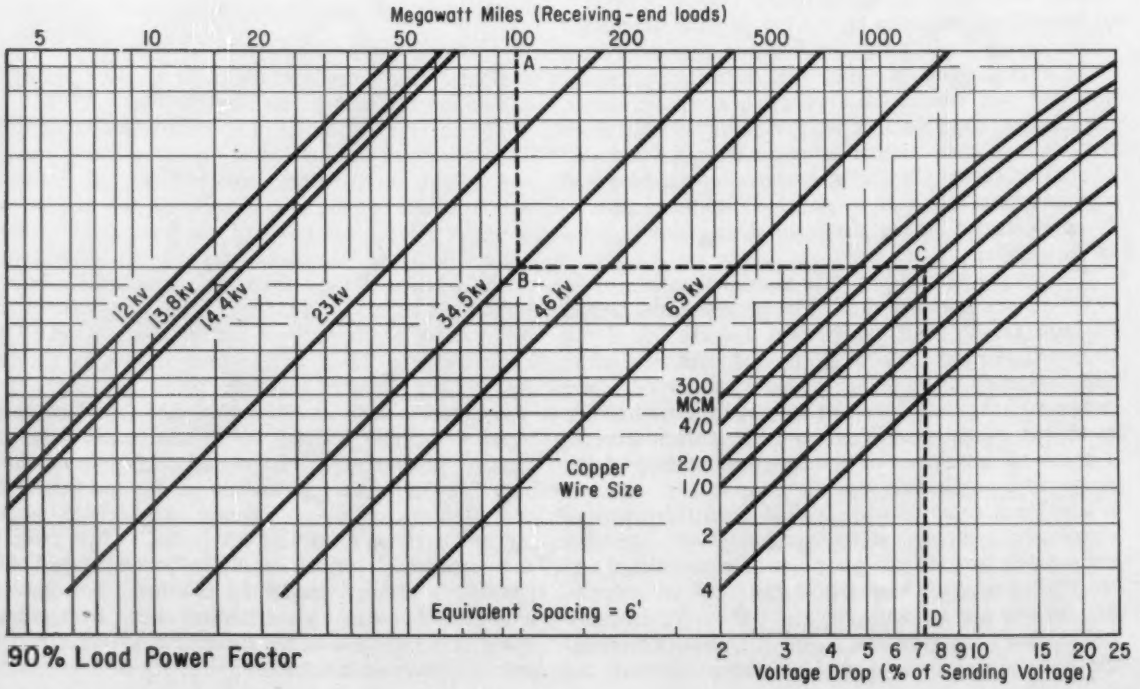
Example

Load	10 Mw at 90% power factor
Conductor	No. 2/0 copper
Distance	10 miles
Sending-End Voltage	34.5 kv

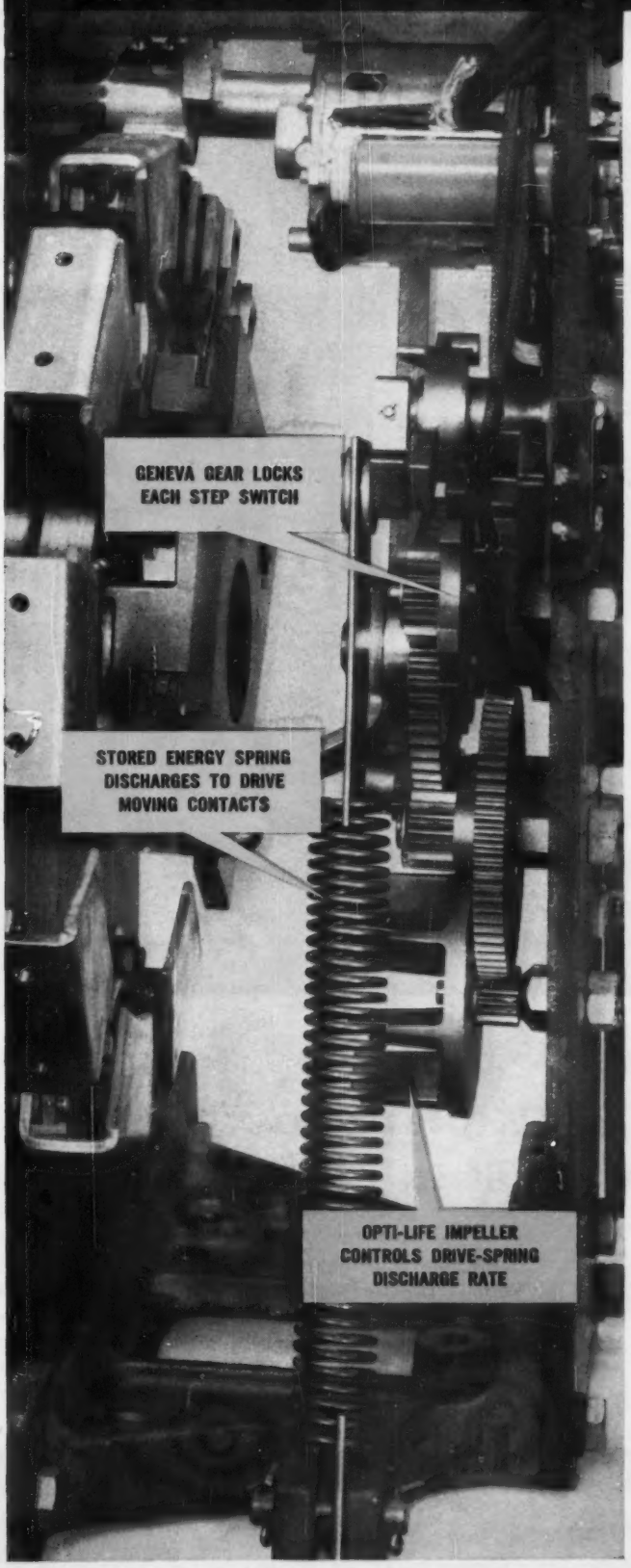
Procedure

Mw-miles $= 10 \times 10 = 100$

Read 100 Mw-miles at A. Follow the dotted line to sending-end voltage 34.5 kv at B to conductor size at C and voltage drop at D of 7.4%. The receiving-end voltage is then 34.5 kv/1.074 = 32.2 kv.



ANOTHER STEP AHEAD IN VOLTAGE REGULATION


GENEVA GEAR LOCKS EACH STEP SWITCH
STORED ENERGY SPRING DISCHARGES TO DRIVE MOVING CONTACTS
OPTI-LIFE IMPELLER CONTROLS DRIVE-SPRING DISCHARGE RATE

CONTROLLED REGULATOR SWITCHING SPEED

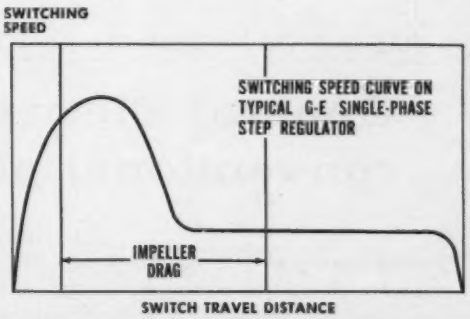
General Electric voltage regulator switches operate 20 years without inspection . . . give you maximum contact life

As regulator users know, there is an optimum tap-changing speed for maximum contact life. Optimum speed must be *controlled* and *non-linear*.

General Electric's exclusive Opti-life switch satisfies these requirements. Results: contacts "break" fast to reduce arcing. Contacts "make" at a calculated rate to (1) reduce mechanical abrasion of contacts, and (2) reduce arcing from contact "bounce."

Truly *controlled* speed of General Electric Opti-life switches is achieved by a fast-action drive, *plus* an oil-immersed impeller which dampens switch velocity as contacts close.

Benefits to you: maximum contact life. In fact, it *isn't necessary to periodically inspect* the interior of a General Electric ML-32 regulator. Under normal operation, switch inspection shouldn't be necessary *for at least 20 years*. You save money!


SWITCHING SPEED
SWITCHING SPEED CURVE ON TYPICAL G-E SINGLE-PHASE STEP REGULATOR
IMPELLER DRAG
SWITCH TRAVEL DISTANCE

FOR MORE REASONS WHY G-E regulators cost less on the line—see your General Electric regulator representative. Or, write General Electric Company, Section 456-05, Schenectady 5, N. Y. *Voltage Regulator Product Section, Pittsfield, Mass.*

Progress Is Our Most Important Product

GENERAL ELECTRIC

THIS GENERAL ELECTRIC BOILING WATER REACTOR PLANT is conventional in appearance, economical in certain high-fuel-cost areas.

A FULL LINE OF NUCLEAR PLANTS TO 500,000 KWE

General Electric BWR plant cost equals conventional plant cost in certain areas

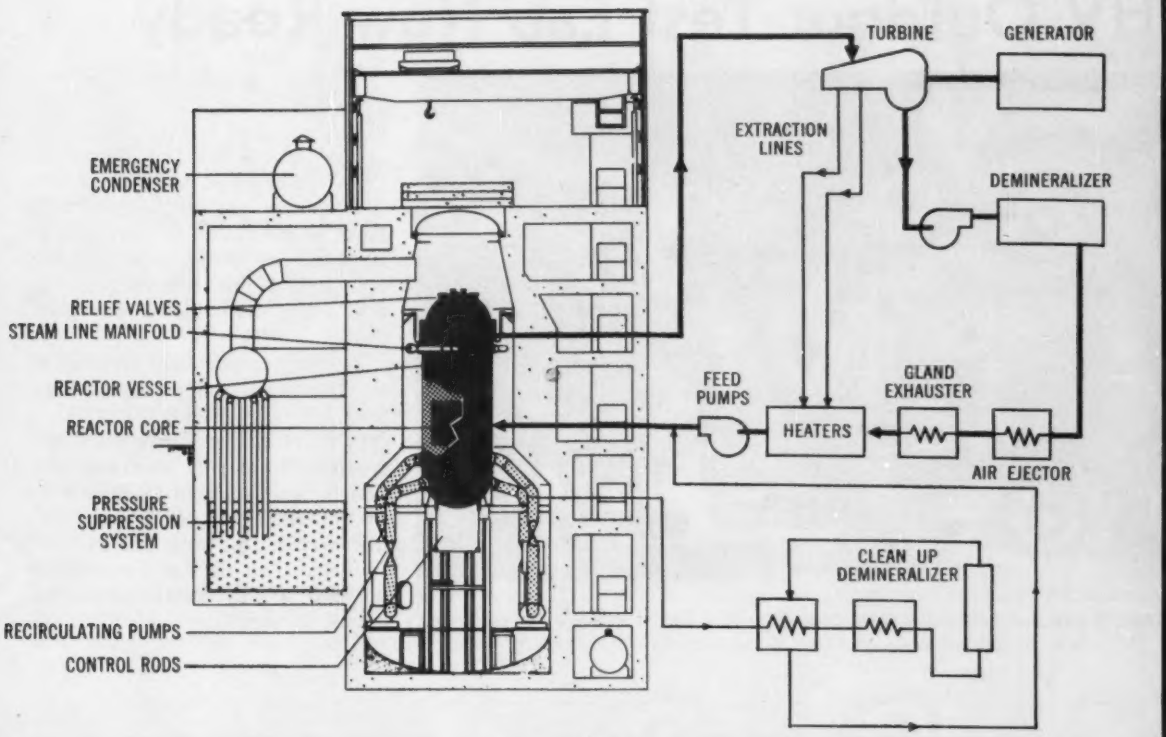
General Electric is now offering a full line of boiling water reactor nuclear power plants rated up to 500,000 kwe. These new plants will be competitive with, or more economical than, conventional plants in certain high-fuel-cost areas.

These advanced designs are now possible because of information from testing and operation of Commonwealth Edison's Dresden Nuclear Power Station, and other results from continuing technical development programs with electric utilities and the Atomic Energy Commission.

Dresden has demonstrated BWR stability, simplicity of operation and control, and ease of maintenance. Technical

General Electric
Nuclear Technology Helps
Keep Power Costs Low

Dresden—
Large Boiling
Water Reactor Feasibility
(Commonwealth Edison Co.)



COMPACT REACTOR SYSTEM arrangement and pressure suppression containment for single-cycle boiling water reactor plants reduces capital cost, simplifies construction. Pressure suppression was developed by General Electric Company in conjunction with Pacific Gas & Electric Co

development program results include pressure suppression containment, steam separation within the reactor vessel, higher core power density, and significant increases in plant rating.

Research and development work is continuing to further reduce the costs of boiling water nuclear plants—projects on fuel design, higher core power density, materials, equipment compaction, and nuclear superheat.

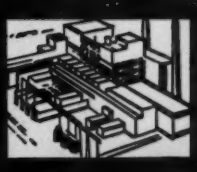
For more information on General Electric commercial atomic activities, contact your nearby G-E Sales Office or write to General Electric Company, One River Road, Schenectady, N. Y. Outside the United States and Canada, contact International General Electric Company, 150 East 42nd St., New York, N. Y. 132-11

BWR PLANT SPECIFICATIONS

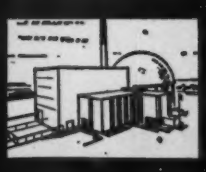
	Natural Circulation	Forced Circulation			
		Single Cycle	Single Cycle	Single Cycle	Dual Cycle
Generator Output (Mwe)	100	200	303	405	500
Net Plant Output (Mwe)	96	191	289	387	481
Reactor Thermal Power (Mwt)	330	618	935	1240	1600
Sat. Steam Pressure at Turbine (psia)	975	1035	1035	1035	pri. .965 sec. .475
Containment System	Pres. Supp.	Pres. Supp.	Pres. Supp.	Pres. Supp.	Sphere

Progress Is Our Most Important Product

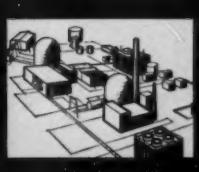
GENERAL ELECTRIC



Humboldt Bay—
Natural Circulation,
Pressure Suppression
(Pacific Gas &
Electric Co.)

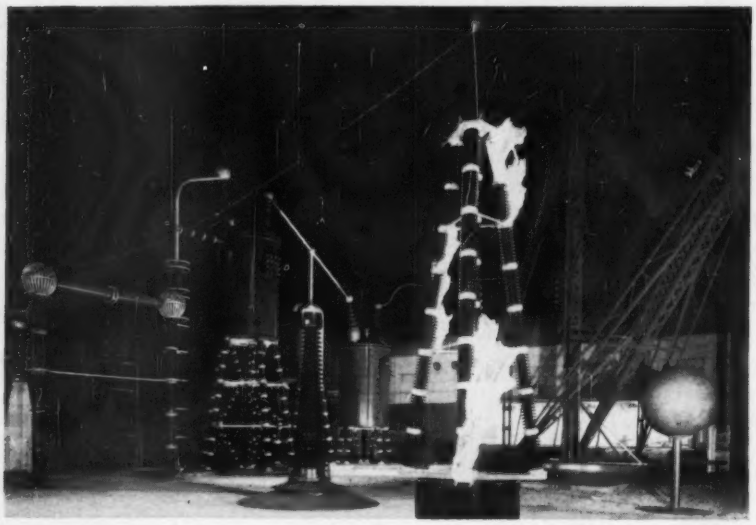


Big Rock—
High Power Density
(Consumers
Power Co.)



EVESR—
Nuclear Superheat
(Empire State Atomic
Development Associates)

HV Outdoor Test Lab Now Ready

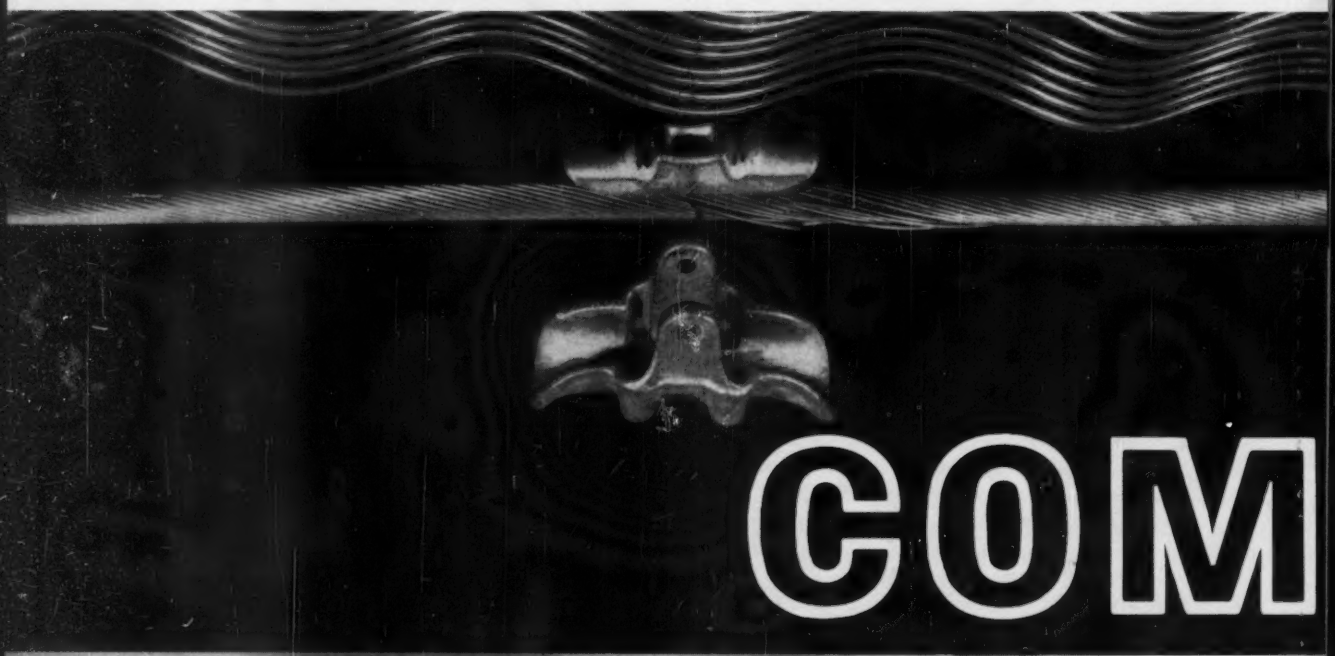


TRIPOD INSULATOR-STACK flashes over on test, at over a million-v line to ground

A three-year construction program has recently achieved a completely new high-voltage test facility at the Ohio Brass Co's Barberton, Ohio, plant. The facilities of this new outdoor test lab, coupled with those of the indoor lab, are said to represent one of the most complete high-voltage test centers currently available to the electric utility industry.

Located immediately adjacent to the company's indoor high-voltage test lab, the outdoor facility is capable of testing transmission line components at well over one million v, and will lead eventually to the development of "all-weather" high-voltage test programs.

Included in the lab's equipment are two 750-kv transformers connected in series, or "cascaded," to


COM
Support: SADDLE CLAMP and ARMOR RODS.
Conductor Sample: 1272 MCM 54/19 ACSR
TENSION (lbs.) | % RBS | Freq. (cps) | Amp. (in.) | Cycles (x 10⁶) | STRAND BREAKAGE
10,000 | 22.3 | 26 | .630 | 176.6 | 17 WIRES BROKEN
176,600,000 CYCLES
1,887 TEST HOURS
AT 22.3% TENSION

produce test voltages up to 1,500-kv (60 cycle RMS) to ground.

Transformer connections and associated fittings have been designed to permit radio influence tests at 600 kv to ground.

A 3,000-kv impulse generator, mounted on steel rails, can be moved between indoor and outdoor labs as needed.

A 15-ton stiff-leg derrick with a 100-ft boom permits swift, safe movement of large pieces of equipment and test specimens around the test area.

Two steel towers have been erected in the yard: one a section of a large 230-kv tower; the other, a platform-type structure. A small portable tower, equipped with a water spray system, is used for wet tests.

Buried under the heavy concrete pad covering the test area is an oil tank which permits immersion of 460 kv and larger transformer and circuit breaker bushings for electrical test.

All control equipment is housed in a glass-fronted control room overlooking the yard. Floodlights illuminate the entire area at night, when many of the lab's heavily scheduled test programs are run.

(*More Manufacturers News, p* 74)

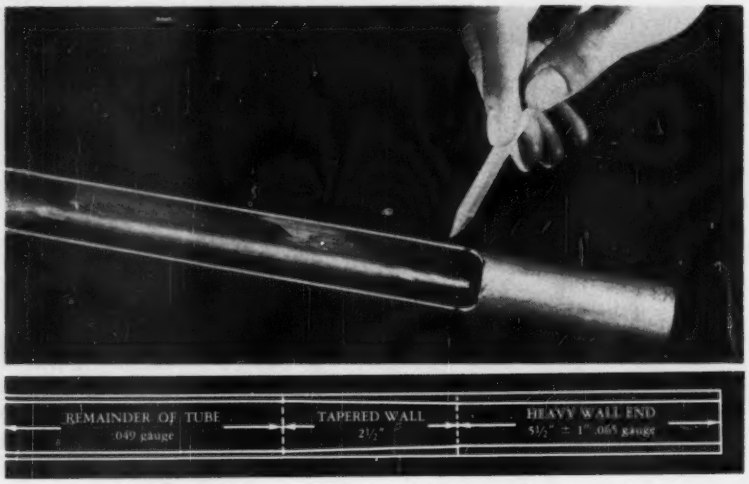
DEADEND SUSPENSION ASSEMBLIES for four-conductor bundle are readied for RI test in the O-B high-voltage outdoor lab. The 3,000-kv impulse generator at far right moves tracks between the indoor and the outdoor laboratories

More News of Manufacturers (*Continued from page 73*)

New Tube Design Plus Automated Drill Mark Advances in

First details on the design of a new condenser tube that combats inlet-end erosion were recently released specifically to *Electrical World* by Chase Brass & Copper Co, Kennecott Copper Corp.

The new tube design incorporates a tapered tube-end. The first 5½ in. of the inlet-end is 0.065-in. gauge and from that point it tapers gradually for a length of 2½ in. to the standard 0.049-in. gauge.



Years ago thickened tube-ends were introduced to the condenser industry to extend tube life and to minimize maintenance problems associated with tube-end erosion. The Chase tapered-end tube is said to be designed to retain the advantages, while minimizing flow turbulence of the "thickened end" tube. Fluid flow turbulence is said to occur in the "thickened-end" tube where the abrupt change in flow path over the thickening-curve produces a low pressure area. This turbulent low pressure area is the source of increased abrasive impingement and excessive wear. The gradually tapered thickening of the new design is said to minimize this type of turbulence.

Using a typical case of erosion attack causing tube failure, Chase pointed out that in six years a conventicnal tube might wear down from 0.049-in. gauge to 0.032-in. gauge. This would be dangerously

What's your line tension phi[illegible]ophy? LOOSE?... "CABLE"?... "CODE"?...or TIGHT?

ARMOR-GRIP
TRADEMARK

Suspension lets
TIGHTER TENSIONS SAFELY
opportunities to SUBSTANTIALLY

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*Long Distance Direct-Dialing Area Code

SEE TEST DATA ON OTHER SIDE

Manufactured under one or more of the following U.S. Patent Numbers: [illegible]; 2,691,065; and 2,722,393

Condenser Field

thin and probably require a replacement or insert. However, with the thickened tapered-end tube, starting with a wall thickness of 0.065-in. gauge, with exactly the same rate of wear from erosion the tube wall would still be 0.048-in. gauge. In short, Chase states six years of life would have been added.

Automated Drill Speeds Fabrication

Worthington Corp's Harrison Division, Harrison, N.J., recently disclosed its use of the world's largest electronically controlled multi-spindle drill. The huge, electronically automated unit, when operating at maximum efficiency, can drill more than 2,000 holes per hr in ¾ in. thick metal plates—in an endless variety of patterns.

Specifically, the holes currently being drilled position the thousands of water tubes in large condensers manufactured by the company. In addition to handling plates twice as large as previous machines (up to 165 sq ft), the new unit simultaneously operates 32 drill spindles as compared with a maximum of 24 spindles heretofore.

The drilling machine, built by Moline Tool Co, weighs 100,000 lb, yet glides on antifriction bearings, under the thrust of a lawnmower type motor. An electronic controller receives drilling instructions from a reel of perforated tape, and in turn relays action instructions to banks of automatic stepping switches for positioning the drilling machine on a two directional axis. Memory circuits arranged on a nearby control panel feed additional instructions to the brain.

It is reported that the new machine will permit Worthington to locate condenser tube holes more accurately than previously, and also permit more accurate control of hole sizes. Also tape control helps solve design and fabrication problems since tapes may be stored and used over and over, whenever the need for a particular pattern arises.

CABLE-MATCHED

OKOPRENE tape is a match-mate for neoprene-sheathed cables . . . is engineered to replace the original sheath...protects against normal environmental hazards and is weather, ozone, oil and chemical resistant.

Other cable-matched Okonite tapes:

OKONITE—for mineral-base rubber insulated cables.

OKOLITE—for oil-base rubber insulated cables.

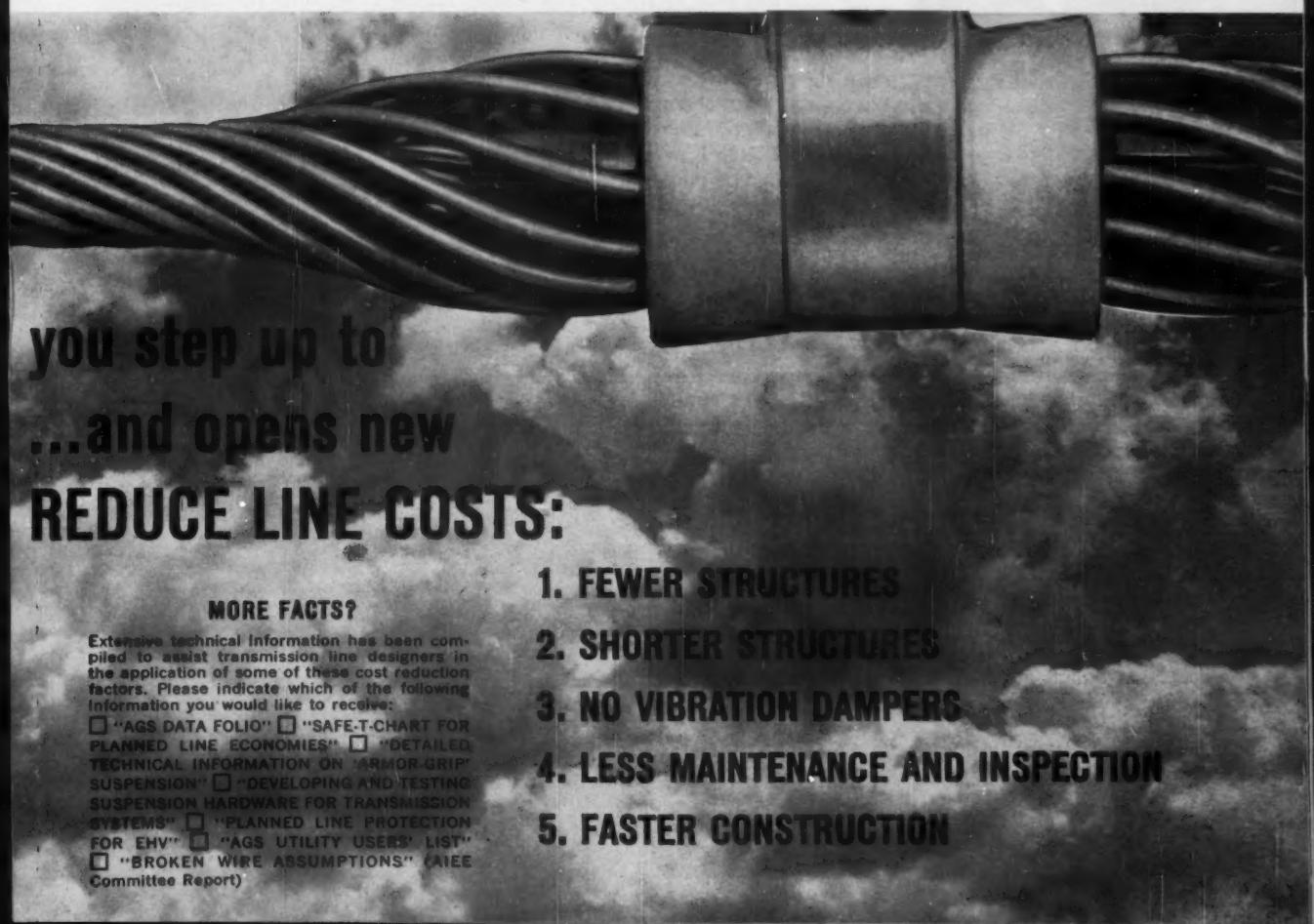
OKONEX—for insulating butyl splices and terminations.

OKOWELD—for insulating and sheathing in one application up to 2000 volts.

MANSON—super-strong friction tape.

The Okonite Company, Subsidiary of Kennecott Copper Corporation, Passaic, N. J.

OKONITE splicing materials
80 years of cable craftsmanship


you step up to
...and open new
REDUCE LINE COSTS:
1. FEWER STRUCTURES
2. SHORTER STRUCTURES
3. NO VIBRATION DAMPERS
4. LESS MAINTENANCE AND INSPECTION
5. FASTER CONSTRUCTION
MORE FACTS?
Extensive technical information has been compiled to assist transmission line designers in the application of some of these cost reduction factors. Please indicate which of the following information you would like to receive:
☐ "AGS DATA FOLIO" ☐ "SAFE-T-CHART FOR PLANNED LINE ECONOMIES" ☐ "DETAILED TECHNICAL INFORMATION ON 'ARMOR-GRIP' SUSPENSION" ☐ "DEVELOPING AND TESTING SUSPENSION HARDWARE FOR TRANSMISSION SYSTEMS" ☐ "PLANNED LINE PROTECTION FOR EHV" ☐ "AGS UTILITY USERS' LIST" ☐ "BROKEN WIRE ASSUMPTIONS" (AIEE Committee Report)

New Equipment

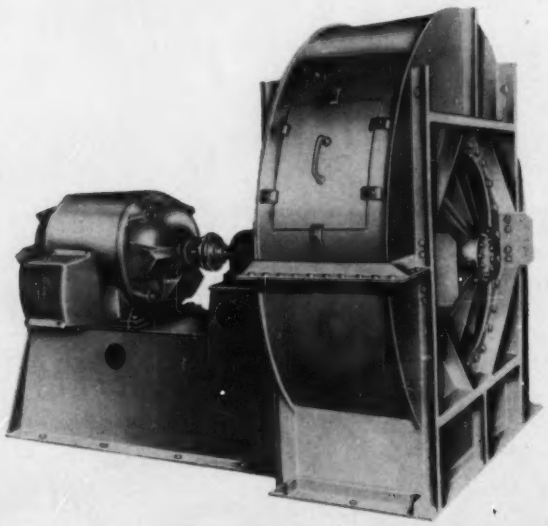
15-Kv Oil Cutouts . . .

. . . both sealed or vented, provide positive load break operation and reliable overcurrent protection on distribution systems. Units are up to 29% smaller and 41% lighter than competitive types. Sealed units should be used only in hazardous atmospheres or where there is a possibility of submersion, such as vaults, manholes and underground network systems. Vented units are for all other installations such as substations, commercial and industrial buildings, shopping centers and schools. Basic difference in the two units is the method of sealing and venting the gases generated during fault clearing. No arc flame occurs in the vented units because fault interrupting arc gases are vented through screening in the fuse carrier hood. In sealed types, gases expand within the expansion chamber. The 15-kv unit augments the lower rated units previously available.
General Electric Co, Schenectady 5, N.Y.

'Do-It-Yourself' Transformer . . .

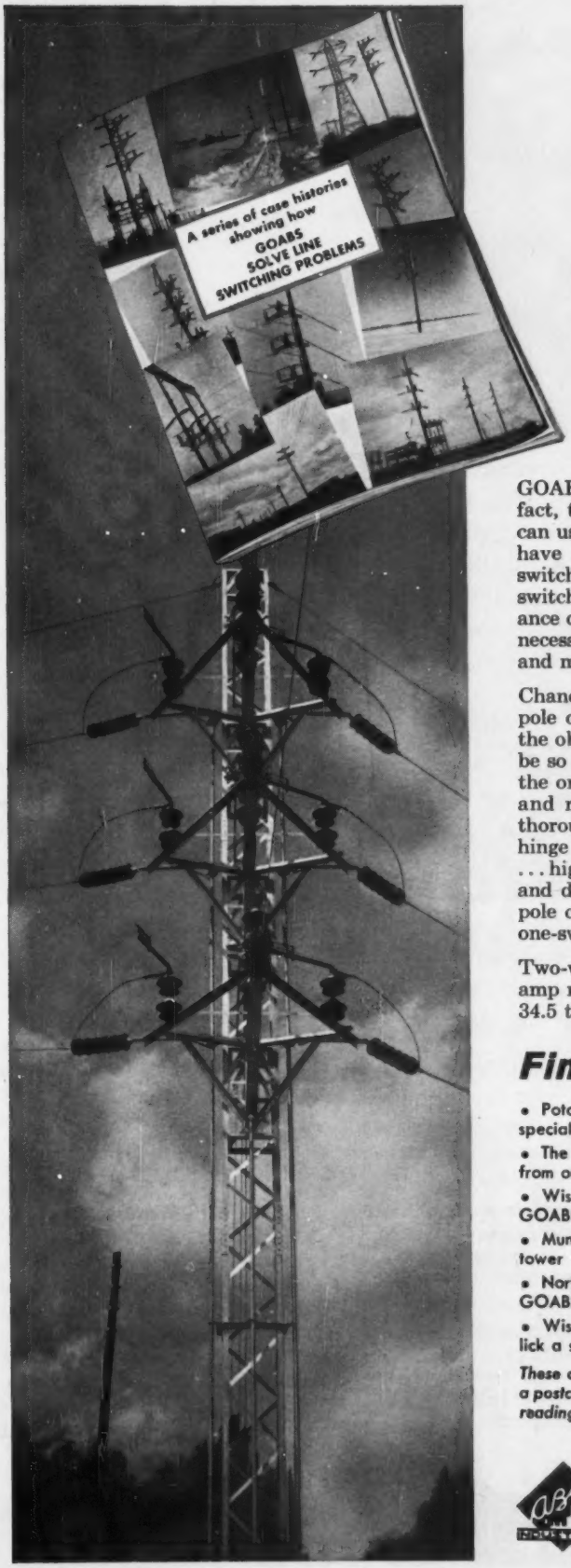
. . . may be used as a temporary or permanent source of ac voltage or current transformer. Required winding turns are hand-threaded through the center opening Flexiformer Packaged Transformer Primary Type TP1000. As a source of ac voltage, input rating is 120/v, 50/60 cycles single phase and the output rating is 1,000 va. Each turn of the hand-wound secondary supplies 0.75 v (at 120-v input). As current transformer, winding becomes the secondary winding, and a current carrying conductor passing through the center opening serves as the primary. For continuous duty, the maximum ratings are primary current 800 amp, secondary current 5.0 amp, with a 160/1 primary to secondary ratio, at an accuracy of 1% at 60 cycles. For intermitten duty, the maximum ratings are primary current, 1,600 amp, secondary current 10.0 amp.
Superior Electric Co, Bristol, Conn.

Centrifugal Fan . . .



. . . features airfoil blading for the direct-connected motor and turbine-class type unit. Series 8500, 15,000 to 450,000 cfm, are available in five ac direct-connected motor speeds: 1,800, 1,500, 1,200, 900 and 750 rmp. Within this range are 24 sizes of AMCA Class III and IV-type fans with wheels from 30 to 109 in. Fans can handle air from —20 to 800F. The bearings are integral with fan unit, and motor is direct-connected to the fan shaft through couplings. Heavy steel construction is used, welded and reinforced throughout to prevent vibration. Housings are built for fixed discharge and split for wheel removal and easy maintenance. Flanged inlets and outlets are standard on all sizes.
Westinghouse Electric Corp, Pittsburgh 30, Pa.

(*More New Equipment on page* 78)



Chance

GOABS do solve many Line Switching Problems

GOABS are not just problem-solving specialty switches. In fact, they are the most efficient and economical means you can use for any tap switching arrangement. But many users have found them particularly valuable in solving specific switching problems like right-of-way restrictions; need for switch controls at one location; demand for improved appearance of lines, less clutter with fewer equipment installations; necessity of making provisions for future expansion of circuits and many others.

Chance GOABS phase above phase installation on a single pole or supporting structure for 1, 2 or 3-way switching is the obvious answer to such problems. Benefits that may not be so obvious without careful checking and comparison are: the one piece welded aluminum frame designed for strength and rigidity so necessary for smooth switch operation, thoroughly tested and field proven . . . sealed silver to silver hinge contacts . . . high pressure straight line jaw contacts . . . high speed arcing horns . . . maintenance free bearings . . . and direct-operating vertical control rods easily located for pole clearance without universal joints that impede smooth one-swing opening or closing.

Two-way and 3-way GOABS are available in 400-600-1200 amp ratings, 7.5 to 69 KV; 1-way in 600-1200 amp ratings, 34.5 to 69 KV.

Find out how...

- Potomac Electric Power Company simplified switching operations in special installations with GOABS.
- The city of Watertown, S. D. used GOABS to provide 3-way switching from one convenient location.
- Wisconsin Power & Light Company cut switch installation costs with GOABS.
- Municipal Public Utilities of Brownsville, Texas installed an aluminum tower and 3-way GOABS (shown at left) in a single day.
- Northern States Power Company plans for future expansion with GOABS.
- Wisconsin Power & Light installed a 1-way GOABS "in a corner" to lick a space problem.

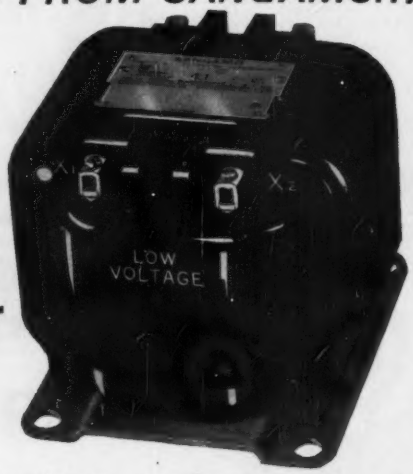
These case histories (and more to come) are yours for the asking. Just write a postcard or letter for "GOABS Case Histories." You'll get some profitable reading. Address:

A. B. CHANCE CO.
CENTRALIA, MISSOURI
(A. B. Chance Company of Canada, Ltd., Toronto)

C561-14

AVAILABLE NOW FROM SANGAMO...

the smallest, lightest T-6 potential transformer of its kind

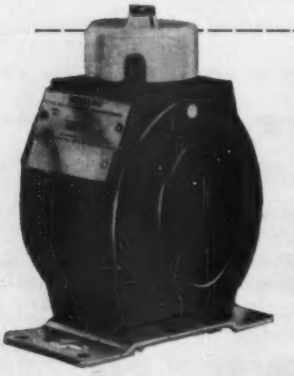


First the BH-6 current transformer . . . and now, a companion potential transformer—the T-6. Compact, epoxy-molded and encapsulated for indoor-outdoor 600 volt class service. Accuracy classification is 0.3 at W and X burdens; actually, the design allows 0.3 accuracy for burdens of two watthour meters, phase-shifting transformer, and demand register (approximately 35 volt amperes).

Impulse level of the T-6 is well in excess of 10 kv full wave, yet it weighs less than 14½ pounds. Liberal cross-section in the secondary winding accounts for a thermal burden rating of 500 volt amperes at 30°C ambient.

The T-6 is small. It measures only 5¾" x 5¼" x 4½". Standard ratios are completely color-coded as follows: 2:1, red, 2.5:1, yellow, 4:1, blue, 5:1, gray. It's built to last, too . . . right down to its alondined and painted aluminum base. Naturally, it meets all of the applicable NEMA standards for indoor transformers of the 600 volt class.

Our suggestion: check full particulars of the T-6 with your Sangamo Representative.



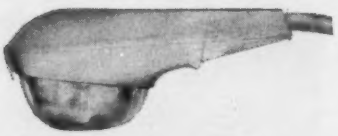
Sangamo BH-6 current transformers lead their class, too. Use them . . . take full advantage of their dual-range feature (a Sangamo first). Eliminate transformer changeouts due to load growth.

BH-6 transformers are epoxy-molded, color-coded, completely encapsulated, lightweight. Large conductor goes through that *Big Hole* easily. Available for all indoor or outdoor applications in a rating for your specific need.

SANGAMO ELECTRIC COMPANY

SPRINGFIELD, ILLINOIS

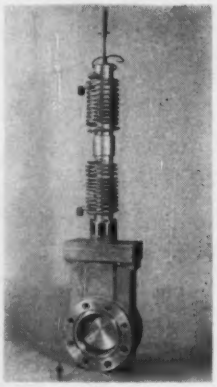
PX61-1



Mercury Luminaire . . .

. . . lights extra-wide roadways which have heavy traffic density, also parking lots and shopping plazas. OV-50 Silverliner for 700 and 1,000-w clear and color-corrected mercury lamps has an optical system which directs light to a large area on the roadway for uniform lighting. Unique latch allows easy access to the lamp, provides tight seal. Each lamp can be controlled by a photocell.

Westinghouse Electric Corp, Edgewater Park, Cleveland, Ohio



Actuator . . .

. . . electrothermal, develops from 30 to 200 lb, with mechanical motion from ⅛ in. to 6 in., or greater. Motion is achieved by piston when actuator is subjected to temperature increase. Built-in heat source is from an externally-controlled integral electric resistance heater immersed in a fluid or wax. Pressure developed as a result of the thermal expansion of the fluid or wax is transmitted as a force to the piston through a synthetic elastomeric seal. The complete device is composed of a heater, thermal element and integral heater-interrupting switch.

Standard-Thomson Corp, Waltham, Mass.

(*More New Equipment, p* 80)

simplify installation . . . reduce inventory

with BLACKBURN PARALLEL GROOVE CLAMPS

TWO sizes make up to 90% of the tap connections required on most distribution systems.

Tools normally carried by linemen are all you need to install Blackburn parallel groove clamps easily and properly. The problem of finding the right die inserts for specific connections is eliminated . . . the chance of human error is lessened.

Inventories can be reduced drastically. Only TWO clamp sizes take wire sizes from 8 solid to 336.4 ACSR, with taps from 8 solid to 1/0 ACSR.

Use these clamps on **aluminum** . . . also on **aluminum to copper** when prefilled with Contax, an oxide-inhibiting paste non-injurious to natural rubber. This also simplifies stocking, reduces the types of clamps needed in warehouses and on line trucks.

For the few installations outside 8 solid—336.4 ACSR main and 8 solid—1/0 ACSR tap range, other sizes are available.

Blackburn parallel groove clamps are engineered for high resistance to weathering, galvanic corrosion, vibration and other enemies of good connections. Construction is of high-strength aluminum alloy, with rocker and spring action to counteract differences in coefficient of expansion when used for bi-metallic connections.

For complete information and test data, send for Bulletin #6007. Samples on request.

Jasper

BLACKBURN

Corporation

1525 Woodson Road • Saint Louis 14, Missouri

DEPENDABLE PROTECTION AT LOW COST

Crapo

GALVANIZED STEEL STRAND

The strong, tough individual wires which make up ***Crapo*** Galvanized Steel Strand are protected against corrosion by a uniform, tightly-bonded, ductile coating of commercially pure zinc. This heavy, dense coating of zinc, applied by one of the time-proven ***Crapo*** methods, not only seals out rust but further protects the base metal by sacrificing itself through galvanic action. The result: long and dependable performance at low yearly cost.

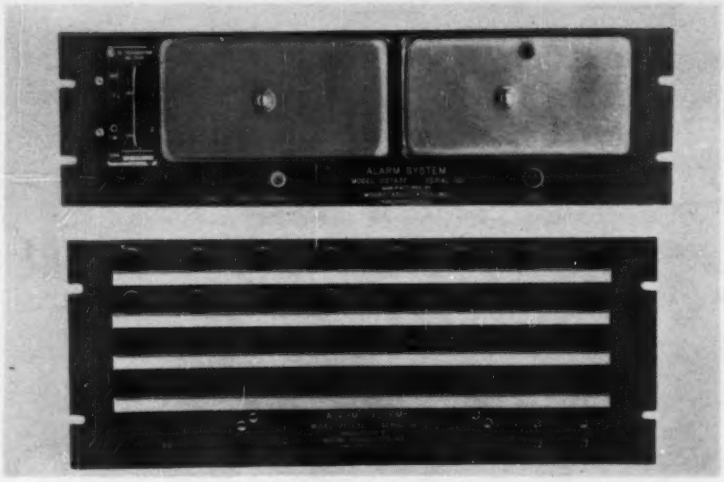
A B C

CHOOSE FROM 3 COATING WEIGHTS

Crapo Galvanized Steel Strand is available in three weights of coating, Class A, B and C. Class B has twice the zinc by weight per square foot of wire surface as Class A; Class C has three times that of "A."

Contact the *Crapo* Galvanized Steel Strand distributer near you for prompt shipments from his stock or from our mill.

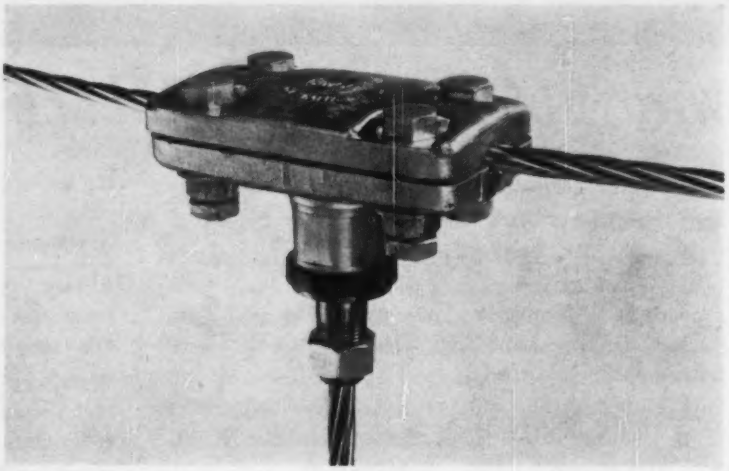
INDIANA
Steel & Wire Co., Inc.
Muncie, Indiana



Microwave Alarm . . .

. . . **features continuous transmission** of the status of all monitored events, whether or not alarms are present. The Marc solid-state fault system consists of unattended microwave repeater station terminals which incorporate a time-division-multiplex coder capable of transmitting up to 128 on-off alarm inputs and a narrow-band frequency shift-tone transmitter. Signals from the coder are decoded at an attended terminal and the appropriate alarm status conditions are visually displayed. An audible annunciator sounds whenever a new alarm is detected.

Moore Associates, Inc, 893 American St, San Carlos, Calif.

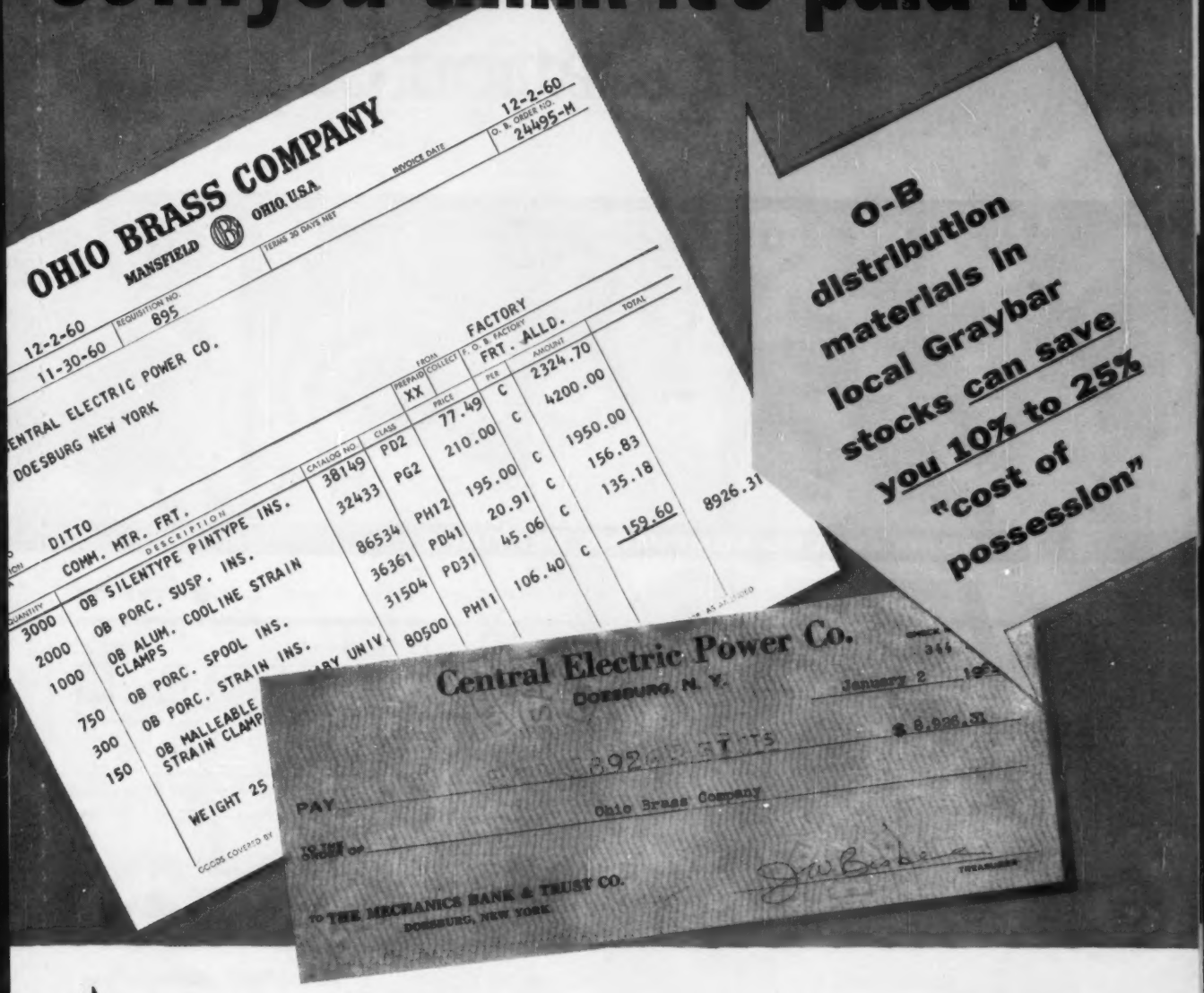


Bi-Metal Connector . . .

. . . **accommodates aluminum conductors** 0.230—0.800-in. dia and copper connectors up to 0.720-in. dia. Unit has high strength die-cast aluminum body; collet of high-conductivity tellurium copper uses patented compression joint in aluminum body. Neoprene washer isolates the dissimilar metals at the exposed junction between body and collet elements.

Aluminum Wire & Cable Co Ltd, St. James' Square, London, S.W. 1

So...you think it's paid for



O-B distribution materials in local Graybar stocks can save you 10% to 25% "cost of possession"

Buy a carload of distribution materials - - save a little, perhaps - - did you really?

What is your cost of possession? Handling in and out, and within the warehouse. Inventory and other paper work. Loss and breakage. Building occupancy. Payroll and other overhead. Capital investment. If you keep all these costs within 10 per cent of what you paid for the material, you are a rare exception. With realistic accounting, cost of possession has gone as high as 25 per cent.

And what do you get for it? Only the convenience of a handy working stock.

Why pay good money for this when it's free? Your local Graybar house will carry stocks of the right kind and in suitable amounts. They will make deliveries to your construction site if you want to save all handling. This is included in standard published O-B prices - - no extras. All they ask is assurance of reasonable usage - - no exclusive hook-up.

And, as a bonus, you get the finest insulators and hardware on the distribution market - - O-B.

Are you looking for bargains? How about getting the best in the business for 25 per cent less than you may now be paying?

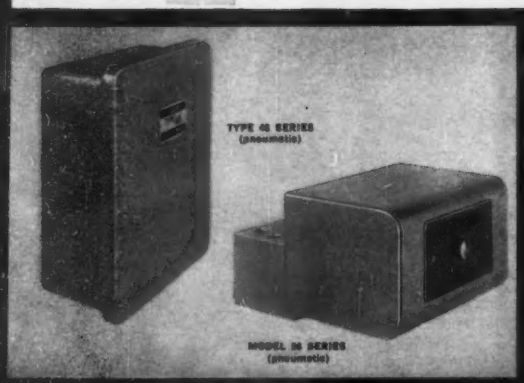
OHIO BRASS COMPANY, MANSFIELD, OHIO

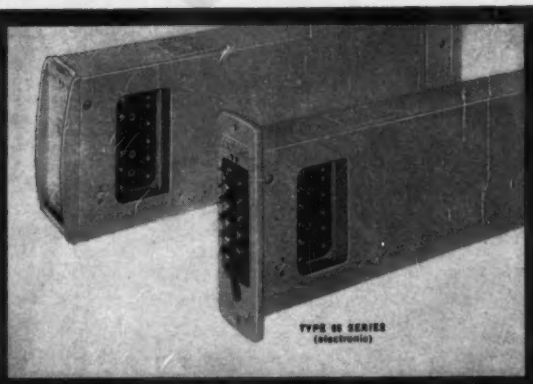
Ohio Brass HOLAN

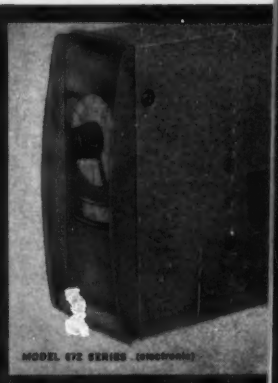
Distributed by Graybar Electric Company

10138-H

new low-cost Foxboro automation of power

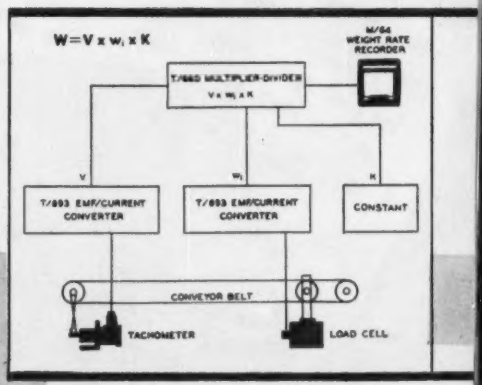






FOXBORO ANALOG COMPUTING STATIONS

▶ TYPICAL



WEIGHT RATE COMPUTATION

Gives operator continuous recording of actual weight of solid fuels being conveyed by belt. For example, T/66D Multiplier-Divider calculates actual weight-rate from load cell and belt speed measurements.

Analog Systems simplify plant computations

both pneumatic and electronic units available

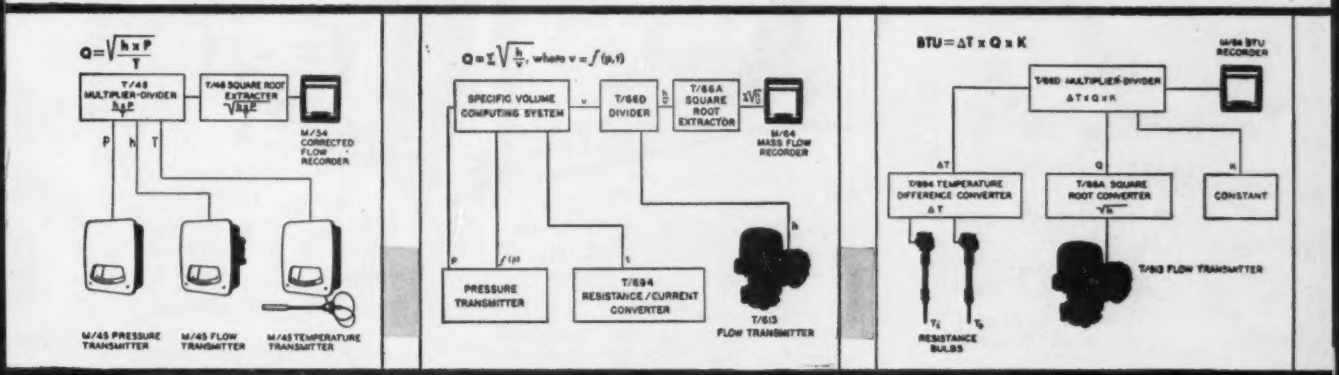
Analog computing systems have been known and used for years. Yet their potential for increasing plant efficiency has hardly been scratched.

Just look what they can do! Continuous calculation of all the arithmetic functions: addition, subtraction, multiplication, division, square root extraction — in any combination. And all done automatically by a single packaged system.

And look how it simplifies the operator's job. Instantaneous calculation . . . with records to prove it. No slide rules, no interpolation, no planimeters — and most important — no mistakes.

Because Foxboro Analog Computer Systems are relatively low-cost ($2500-5000 average) you can "spot" them about your plant for maximum efficiency. Or, they can be grouped together at a central location to solve more complicated equations. Pneumatic and electronic systems available.

CALCULATIONS MADE WITH FOXBORO ANALOG COMPUTING SYSTEMS



GAS FLOW COMPUTATION
In common use to compensate gas flow readings — air and fuel — for changes in line temperature and/or static pressure. In the pneumatic system shown here, the Foxboro T/46 Multiplier-Divider and the Square Root Extractor allow operator to read corrected flow directly.

MASS STEAM FLOW COMPUTATION
Calculates weight-rate of superheated steam flow, through a specific volume computing system individually designed for each application. Pressure, temperature, and flow measurements are combined so operator can read mass steam flow directly on a M/64 Recorder.

BTU COMPUTATION
Determines actual amount of heat being transfered to or from a heat exchanger. Electronic system shown uses a Foxboro T/66D Multiplier-Divider to produce a signal equal to product of flow and temperature difference. Operator reads directly in Btu's.

WHAT CALCULATIONS WOULD YOU LIKE TO AUTOMATE? ➔

FOXBORO
REG. U.S. PAT. OFF.

The Foxboro Company, 247 Norfolk St.
Foxboro, Mass.

I have a plant computation I should like to automate. Can a Foxboro Analog Computing System do it for me?

I want to compute.....

.....

Name.....

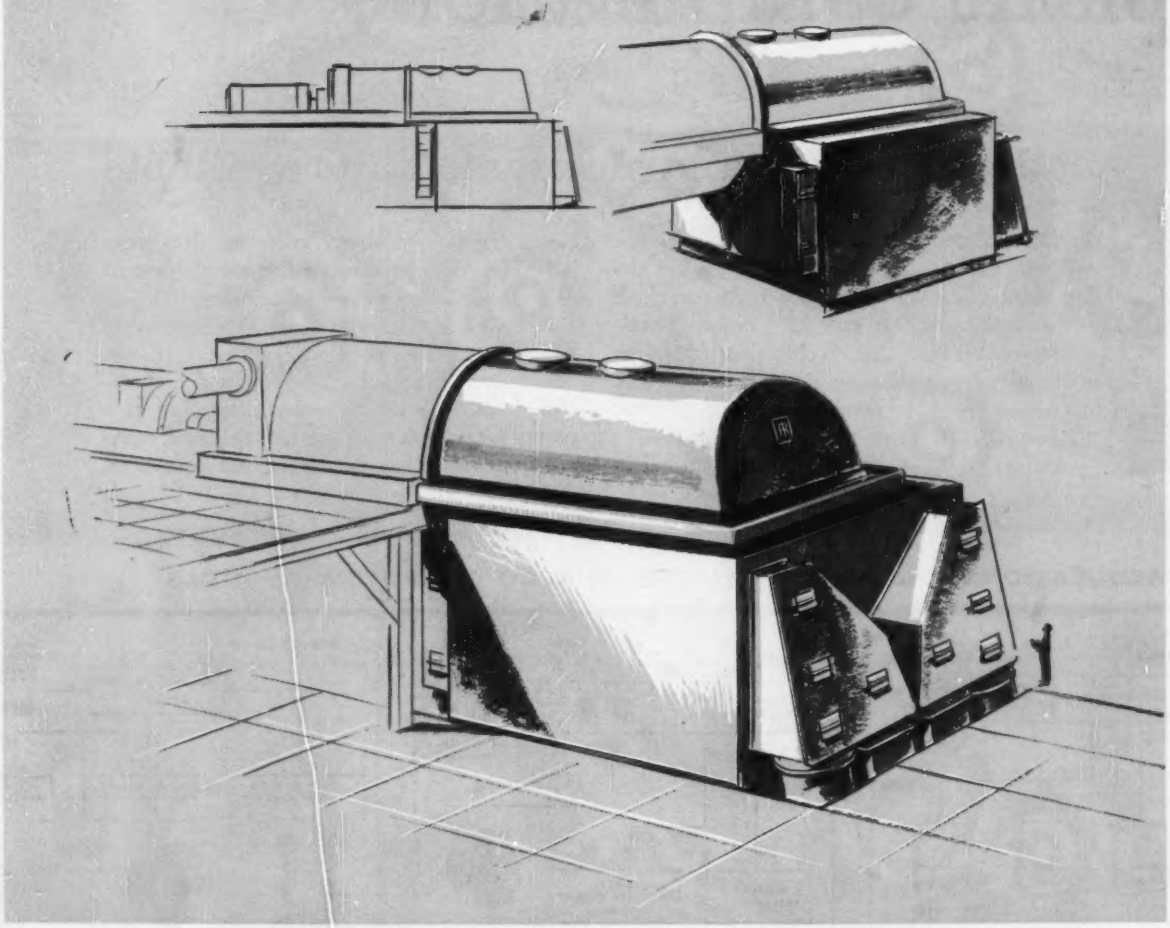
Position.....

Company.....

Address.....

City.....**State**.....

Adding new dimensions *to engineering*



Here's the latest concept in steam condenser design*

(You'll be hearing about this one for a long time to come)

In no other installation has a surface condenser so completely matched the characteristics of the axial-exhaust turbine it serves. For the first time the condenser tubes have been arranged to parallel the turbine shaft resulting in a steam-flow path that is optimized to provide just the right back-pressure for high-efficiency turbine-condenser operation. At the same time, the condenser is arranged to complement the overall station planning—space requirements are minimized and piping is simplified without sacrificing accessibility.

At Ingersoll-Rand we like to apply new ideas and design concepts to the *overall engineering problem.* That's why I-R condensers continually set the pace for highest performance and adaptability to any *turbine-condenser arrangement.*

**Ingersoll-Rand*Ingersoll-Rand Axial-Inlet Condenser with 145,000 sq. ft. of surface for Southern California Edison Company's Alamitos Station, Units 3 and 4.*

PUMPS • CONDENSERS • EJECTORS & VACUUM PUMPS
AIR & ELECTRIC TOOLS • AIR COMPRESSORS

Ingersoll-Rand
11 Broadway, New York 4, N.Y.

Selling

A $2-million street lighting improvement project has been petitioned for by a majority of property owners in a 66-block downtown Denver, Colo., area. If the City Council approves the plan, owners will contribute $500,000, Public Service Co of Colorado will pay $1.3 million in installation costs, and the city will finance $250,000 in traffic signal modernization. Program proposes placing 778 tapered poles, 32-ft high, with 1,000-w mercury vapor lights in the area over a three-year period, which will provide ten times more light than present system . . . **Fourteen** Vancouver, British Columbia, housewives are making the rounds calling on B. C. Electric Co's 275,000 customers to explain to other housewives how the utility works. Team explains what a kilowatthour is and what it costs, settles complaints about bills and service, and shows the housewife exactly what her electricity costs. Program was started because more than 80% of the BCE's customers pay their bills by mail or at pay stations and the company has no contact with these people . . . **"Electra City, U.S.A."** exposition will be held October 21-29 at New York City's Coliseum. Theme will be "Try Before You Buy" and consumers will be invited to test on-the-spot the latest portable and major appliances developed by leading manufacturers.

Electroluminescent lamp, measuring 8 ft x 2 ft, which is reportedly the world's largest, has been produced by Sylvania Electric Lighting Products. Constructed of a steel base with ceramic and phosphor coatings, the panels are expected to last more than five years . . . **"Builders Showcase,"** a TV program which will tour new quality homes and apartments, will be co-sponsored Consolidated Edison Co of New York Inc. Program will concentrate on describing such features as built-in major electric appliances, special lighting effects, adequate wiring and other conveniences aimed at interesting prospective buyers. Program will be shown on Sunday mornings, timed to hit the television audience just before they might start on their Sunday afternoon search for a new home . . . **Students** in a Florida high school recently purchased one share of Tampa Electric Co stock, and three students, as representative stockholders, attended the company's annual stockholder meeting. While at the meeting they were introduced to President W. C. MacInnes, and other stockholders, were taken on a tour of the offices and given information on the company's operation. Purpose of the stock venture: To teach the students the functions of capitalism.

Best complete advertising program award of any utility in the US has gone to Southern California Edison Co. The award in the Public Utilities Advertising Assn's 38th Annual Better Copy Contest was given for Edison's Medallion Home advertising. The company also won second place for the best single advertisement on area development . . . **First prize** for motion pictures in the Better Copy Contest went to Atlantic City Electric Co for its film, "Southern New Jersey—Land of Vigor." The film depicts economic advantages of southern New Jersey and was produced by the utility as a public service. Connecticut Light & Power Co and Cleveland Electric Illuminating Co won second and third prizes.

Domestic refrigerators and freezers apparently can be built with considerably thinner walls using available insulating materials, according to Severn Joyce, manager of appliance and equipment sales, Owens-Corning Fiberglas Corp. Concentrating on the transfer of heat in a direction perpendicular to the wall surface, company engineers determined that a refrigerator wall insulated with heavy gas-filled polyurethane foam can be made as thin as one inch. A refrigerated wall insulated with air-filled fibrous glass can be made as thin as 1.3 in. and achieve equal thermal performance to foam materials at substantially lower costs. For copies of the test report, write: Mr Joyce, Owens-Corning Fiberglas Corp, Toledo 1, Ohio.

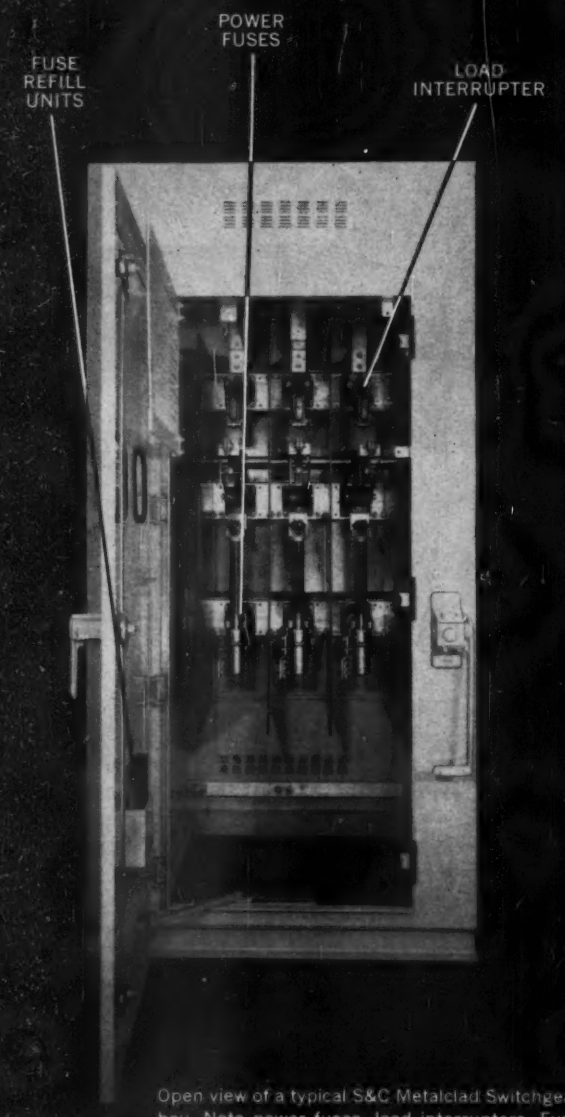
NEWS from LAPP

Hi-F

FOR TODAY'S TRANSMISSION REQUIREMENTS THE FIRST "FUNCTIONAL DESIGN" SUSPENSION INSULATOR IN MORE THAN A GENERATION

See next week's Electrical World

Reclosing is for the birds



Open view of a typical S&C Metalclad Switchgear bay. Note power fuses, load interrupters. Fuse refill units are conveniently stored in the door.

So why buy this feature in your 2.4 thru 14.4-kv switchgear?

Reclosing is for the birds, squirrels, tree limbs, lightning, icing, windstorms, and kite strings that frequently cause non-persistent faults on open distribution lines of utility systems. Reclosing re-energizes the lines to restore service in a fraction of a minute.

But when faults occur on the enclosed power supply circuits of industrial plants, commercial and institutional buildings, you don't want to reclose on them. These faults —while extremely rare—are permanent. Someone has to locate the trouble and repair the equipment or cable—or at least isolate it—before the system can be re-energized. So why buy expensive circuit breaker type switchgear with its automatic reclosing feature?

S&C Metalclad Switchgear—employing fused load interrupters—gives the ideal protection for enclosed power supply circuits. Power fuses furnish the fault protection (load interrupters switch the load). After a fault occurs, you simply replace the inexpensive fuse refill unit (typically costing $13.50) while the fault is being located and corrected.

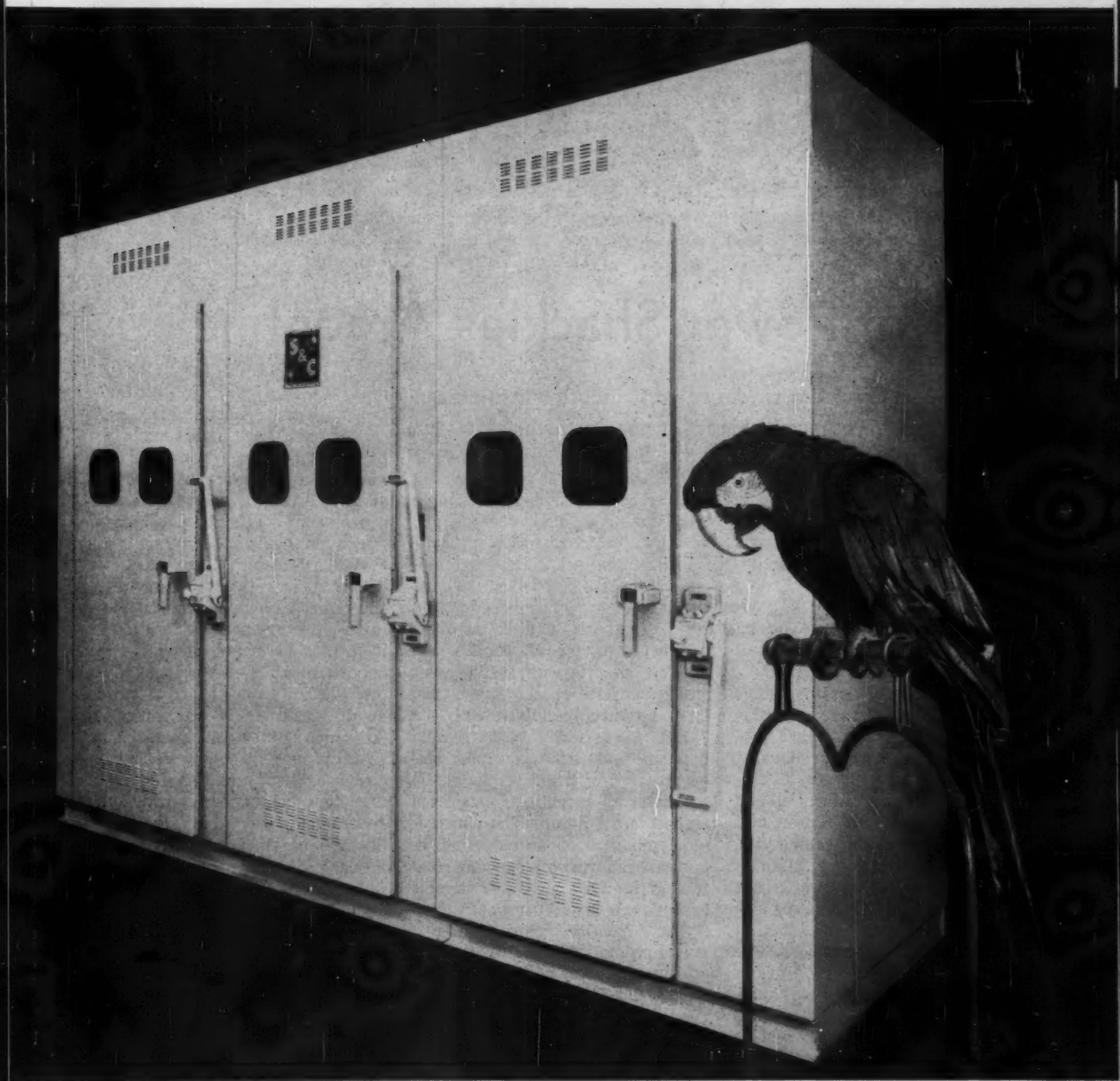
The economics all say, "Reclosing is for the birds." Why pay for a function you can't use?

Cut your high-voltage switchgear costs in half by specifying S&C Metalclad Switchgear for your 2.4 thru 14.4-kv switching centers, service entrances, substation primaries and secondaries. Get full-load switching to 1200 amperes and fault interrupting to 500,000 kva.

See the Yellow Pages (Electrical Equipment) for your nearest S&C sales engineer. Or write to:

S&C Metalclad Switchgear meets all NEC requirements for fault-closing, short-circuit interruption. Performance proved by high-power testing at KEMA laboratories.

S&C ELECTRIC COMPANY
4421 Ravenswood Avenue • Chicago 40, Illinois
Specialists in High Voltage Circuit Interruption since 1911



The equipment is an S&C Metalclad Switchgear Assembly rated 13.8 kv, for a switching center.
The bird, a green-winged macaw, is an optional extra, obtainable at your local petshop.

KAISER ARGENTINA AUTOMOBILE'S NEW PLANT in Cordoba is typical of modern factories being built in Argentina. The sprawling complex includes a forge line, motor assembly lines, and test labs. Construction began in 1955

Lack of Power Shackles Argentina

Nation is making great strides toward industrialization but lack of power threatens to hinder further growth

A shortage of electric power is choking Argentina's efforts to swing from an agricultural economy to one based on heavy industry. Some industry is already in fullscale operation within the country. And the incentives offered by the government seem adequate to attract much more. But the shortage of power is crippling the program.

Established industries are unable to expand. New ones are being frozen out. With a per capita production of only 494 kwhr annually, the country cannot supply its factories, or even its residential and commercial consumers. Power cuts over vast zones of the capital city, Buenos Aires, are a daily affair.

There's no simple answer to the question of why electric power isn't coming along as rapidly as other industries. Perhaps it is still recovering from blows dealt it by previous governments. But curiously enough, electric power is the one industry for which the government hasn't solicited foreign capital and assistance. Electrical generation has largely been nationalized. And it simply isn't sharing in the prosperity which international cooperation has brought to other industries.

The shortage of power hasn't always been a pressing problem to this country which is regarded by many as the richest in Latin America. Historically, it is an agricultural nation with a small industrial load. In fact, its agriculture is so rich that it has been able to meet all of its past needs for manufactured goods through imports with surpluses of grains, cereals, beef, hides, and forest products footing the bill.

But the growth of Argentine population plus the need for a better standard of living precludes the purchases of essential goods from abroad in the future. The nation is now embarked on an industrialization program which is showing great success in most areas. A notable exception is in electric power.

The Argentine philosophy is that power generation is the work of the government. This philosophy began during the Peron regime. In two giant bites, the Peron government swallowed the properties of American & Foreign Power, then one of the nation's largest producers of electricity. Since then, the government has bought out CADE, the Belgian system which serves the country. Although the government owns CADE facilities on contract, Belgian management has been carried on. Argentina has made two payments on this system, and will make eight more over the next eight years. By then, management and operation of the system will be in Argentine hands.

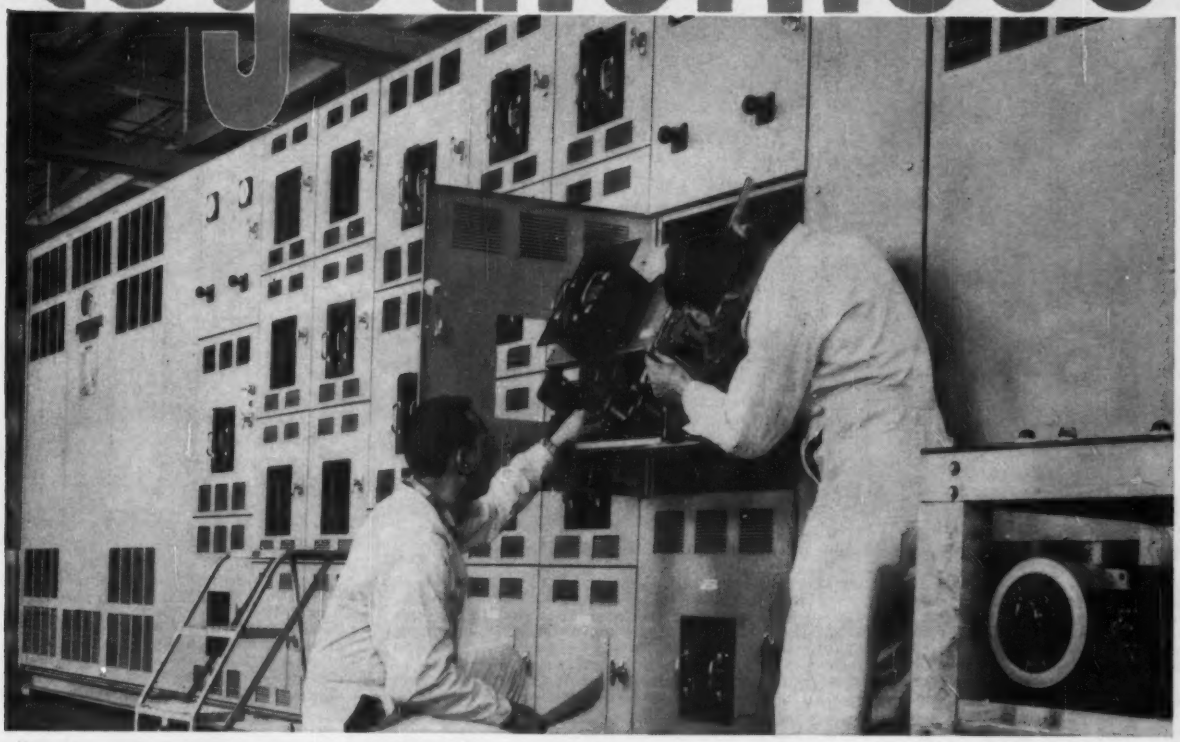
A third foreign-financed utility, primarily under Swiss management, still remains in private hands. How future government policy will affect its operation is not known. It is enough to say, however, that over the past ten years, two of the three major international companies in Argentina have come under the government. This is a trend in exactly the opposite direction of that for other industries where the government is offering the most liberal concessions to attract foreign investment and management.

Is this government ownership strengthening the Argentine power industry? Certainly the national program for future generating and transmitting facilities is extremely ambitious. But looking at the past record of electric power, the utilities haven't done too well since they were nationalized. At least, they have fallen far short of the country's demand. Production in Argentina is about 7.8 billion kwhr. Present demand is about 13 billion kwhr.

(*Continued on page* 92)

PENNSYLVANIA
UNIT SUBSTATIONS
A PRODUCT OF

togetherness



*** built together.** Centralized production, scheduling, quality control—these are some of the advantages you gain from Pennsylvania; where substations are engineered together, built together, shipped together.

This kind of togetherness means close association between engineering and manufacturing, so that special requirements are swiftly met, communication accurately directed. It means rigid, uniform quality control of all components at one location. It means coordinated production scheduling within one modern facility where all components of each substation are built together. And it is your assurance of complete, on-time delivery.

Write for handbook No. PSG-559, which provides extensive engineering and application data on Pennsylvania Secondary Unit Substations. Unit Substation Department, Pennsylvania Transformer Division, McGraw-Edison Company, Canonsburg, Pennsylvania.

developed
engineered
* built
tested
shipped
serviced

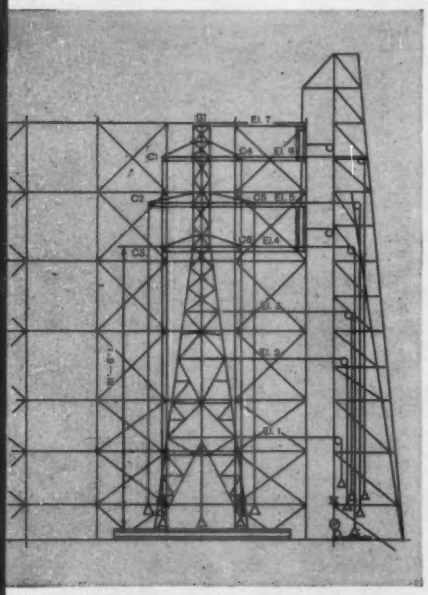
together

McGRAW EDISON

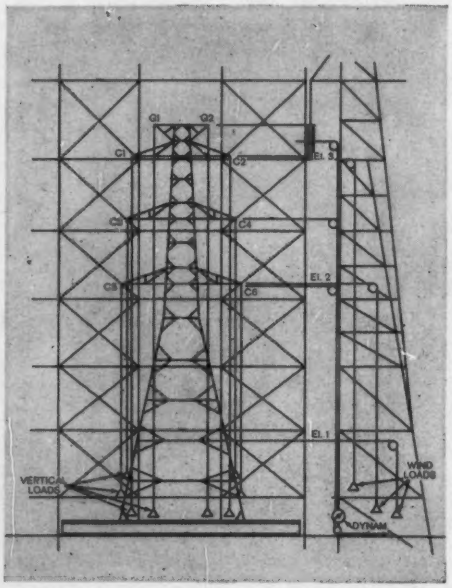
To prove out new designs . . . American Bridge tests full-scale transmission towers to destruction

Who knows for sure what a hurricane or heavy ice loads will do to a new type of transmission line? To help find the answers to these and other questions, American Bridge has maintained for over 30 years the world's largest tower test frame at its Shiffler Plant in Pittsburgh, Pa.

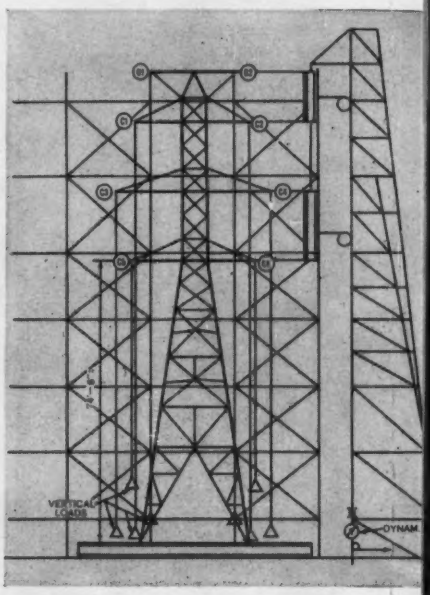
New tower designs and how they are tested by American Bridge



Suspension Tower, American Electric Power Service Corp. This test of a very light 138-KV tower was made to prove that such structures can be designed and fabricated of steel and marketed in competition with competitive materials. The design was extremely light, and the quantity of towers required was sufficient to warrant a test which proved the tower strength.



Double circuit suspension tower, West Penn Power Company. West Penn Power design engineers designed the pictured structure to solve some of their future transmission line problems. This was an extremely unique design using the Vierendeel truss concept, to our knowledge for the first time in transmission towers. The tower passed the required load tests and is soon to be in service for the West Penn Power Co.



230-KV Tower, Public Service Company of Indiana, Inc., Sargent & Lundy, Engineers. Sargent & Lundy designed this rectangular base, double circuit tower to be economical in the use of steel and thus lower costs. The large number of towers justified many design refinements, and the tests proved the lightweight tower exceeded requirements by an adequate margin.

Vertical loads are applied by suspended trays, loaded with steel plates, and attached to the flexible hanger brackets on the conductor crossarms, and to the U-bolt on the ground wire peak. These trays are raised and lowered manually and independently by chain blocks.

Wind loads are also applied with suspended trays loaded with steel plates with lines attached at various elevations, usually six. These loads are transmitted to the tower through strain plates at the ends of the conductor crossarms and by tying the cable around the tower legs. Wind load at the ground wire peak is included as a portion of the transverse load.

Transverse loads are applied by a screw mechanism and measured by a dynamometer connected in series. These loads are transmitted to the conductor crossarms through the flexible hanger brackets, and to the ground wire peak through a strain plate.

Longitudinal loads are applied by a screw mechanism and measured by a dynamometer connected in series. These loads are transmitted to the conductor crossarms through the flexible hanger brackets, and to the ground wire peak through the U-bolt.

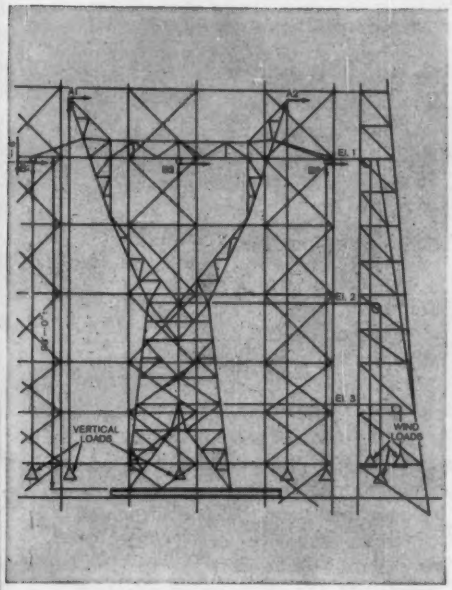
Deflection readings are taken at the ground wire peak, and at the bottom crossarm, in both longitudinal and transverse faces.

Different towers require some changes in these setups but generally the methods are similar for all tests.

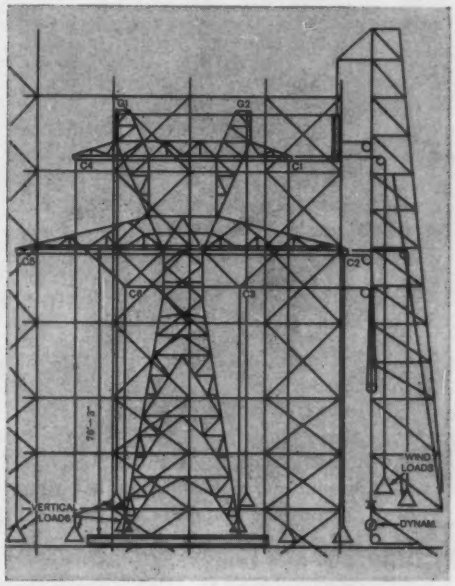
Testing is generally confined to transmission tower structures which are to be used in great numbers. Although testing a full-scale structure is naturally an added expense to the line, the tests pay for themselves in proving that economical, lightweight structures can be made to do the required job. Any combination of loading conceived by the engineers can be applied simultaneously with these test facilities.

With the use of higher voltages and bundled conductors, tower designs in recent years have gone through many changes. Our test facilities are available to the electrical industry to prove out any new ideas.

This mark tells you a product is made of modern, dependable Steel.



460-KV Tower, Tennessee Valley Authority. This 460-KV single circuit structure was the largest tower of its type ever to be tested. The Tennessee Valley Authority is now constructing a section of 460-KV using these structures and intends to make further use of this type of structure in future transmission lines.



Suspension Tower Type 2A, Ohio Edison Company, Commonwealth Associates, Inc., Engineers. Commonwealth Associates, Inc., designed the unique delta-type, double-circuit 345-KV structure. Because of many innovations in design and its extreme light weight, the tower was tested to determine if the structure was adequate for the design loads.

American Bridge, the world's leading transmission tower specialist, pioneered the use of USS MAN-TEN High Strength Steel with A-7 Carbon Steel to trim a ton or more of dead weight from the average tower. Recently, we designed towers to carry the highest voltages likely to be used for the next decade.

For more information or recommendations based on your requirements, write American Bridge Division, United States Steel, 525 William Penn Place, Pittsburgh 30, Pennsylvania.

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Power Shortage Shackles Argentina (*Continued from page* 88)

There are also hints that the future of the nation's power under government management does not look completely promising. The outstanding instance is the South Dock power station fiasco.

South Dock is a large power station (unofficially reported to be 600-Mw) which was begun several years ago. One report holds that some of the steel work was put in place, and that one of the turbines was actually shipped from a European manufacturer. Financial difficulties brought construction to an abrupt halt, and forced the Argentine government to seek financial help from the World Bank. The World Bank studied the project, and concluded that private financing, and transfer of the project to private enterprise was the soundest approach. But Argentina's policy of nationalized power made this solution unacceptable.

At present, Argentina is working toward a compromise solution in which the project would be jointly owned and managed by the government and private interests. The World Bank is withholding its support until new proposals are presented. But if the country persists in demanding government ownership, then money for other projects may be just as hard to find.

Other Industries Prosper

On the other hand, there seems to be plenty of capital for Argentina's private industries. When these industries are to be developed Argentina tries to combine national firms working in the field with one or more foreign firms. The resulting international group is then given tax concessions where such concessions are important, and sent to work. From the results, this approach seems to be highly effective.

Petroleum production, for instance, was at 5.6 million cubic meters in 1958. It rose to seven million in 1959, and 10.2 million in 1960. It's still going up.

The petrochemical industry is another that is growing rapidly. Petroquimica Argentina (PASA), organized by Continental Oil, Cities Service, US Rubber, Witco and Fish International Corp, hopes to establish nine factories with a production capacity of 14,000 tons of styrene, 32,000 tons of butadiene, and 45,000 tons of synthetic rubber Argentina expects that this industry will soon provide for the country's needs with something left over for export.

Chemical production is growing also. New plants are in the planning stage which will produce 75,000 tons of sulphuric acid, 14,000 tons of carbon disulphide. Some 60 companies are now engaged in producing paints and varnish satisfying about 80% of the local need. Many companies of varying importance manufacture soaps, toilet articles, and cosmetics. Most of them are of national origin. However, there are a few important foreign firms: the Unilever group (Lever Harmanos & Atkinson) Colgate Palmolive, American Home Products, Chesebrough Ponds, and others.

A host of foreign companies has put greater life into the nation's pharmaceutical industry. These include Eli Lilly, Johnson & Johnson, Lederle, Merck, Parke Davis, Pfizer, Squibb, Schering-Bayer and many more.

Electric Outlook Is Gloomy

Similar international groups are developing an iron and steel industry, manufacturing tractors, automobiles, trucks, motorcycles, textiles, paper, cement. But no similar international vigor is pushing power development, and the present picture for electric energy is clearly gloomy.

When PASA starts construction of its new $70-million petrochemical complex in September, the site will be San Lorenzo—nearly 300 miles north of Buenos Aires. This is not an ideal industrial site, but Buenos Aires and other industrial areas are simply out of electricity. The plant goes to San Lorenzo because it is the end-point of the Campo Duran-San Lorenzo gas pipeline, and in the area there's some surplus of natural gas.

Others of Argentina's many proposed and planned industrial plants will be facing the same problem. Some will be forced far from present industrial centers. Some will have to put part of their capital into industrial power plants cutting back on funds that could be used for production facilities. Some may even face postponement.

Excluding industrial plants, Argentina now has about 2,300 Mw in public service. If industrialization is to proceed, this figure must be raised several times in the next few years.

Basically, the government has two plans in mind. One, now in operation, is a five-year plan to complete new plants already being constructed, and to expand existing ones. The second plan calls for the construction of completely new major plants. The success of the second plan depends entirely on Argentina's ability to arrange satisfactory financing from abroad.

As part of the first plan several thermal and hydro plants are already well under construction, while two thermal plants are being expanded. This work promises the country 935 additional thermal Mw by 1965, and 364 Mw of hydro. This coupled with industrial plants may bring the nations capacity in 1965 close to 4,000 Mw, or a production capacity of nearly 16 billion kwhr.

Future Rests on Second Plan

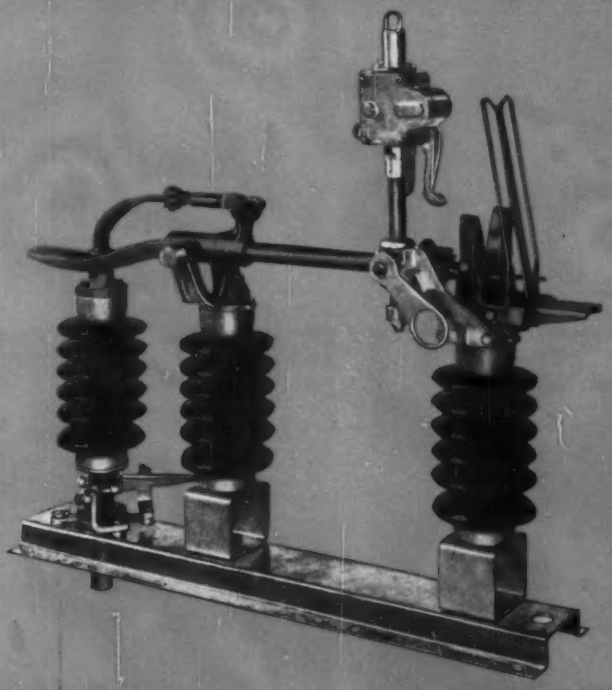
But demand today is at 13 billion kwhr, so even this figure, if it is reached, doesn't offer Argentine industry any great growing room.

The future of the country seems to lie in the second plan.

In the discussion stage are several ambitious hydro projects. Two are international in flavor, the Salto Grande plant on the Rio Uruguay which would deliver about 700 Mw to Argentina, and 700 Mw to Uruguay, and the Apipe plant on the Parana, which would produce about 1,500 Mw to be divided between Argentina and Paraguay. Another series of projects on the Rio Limay could offer the country better than 2,200 Mw. Several other discussed projects could produce an additional 1,000 Mw. This means that 4,650 Mw in hydro plants are available to the country in the future. To supplement this, many major thermal plants will have to be built, along with a high tension grid.

Argentina readily admits that the future of these projects depends upon the availability of foreign capital. But how available foreign capital will be to an industry which is heavily nationalized is a question that is yet to be answered. The World Bank has said "no" in the past. Argentina seems to be pinning its hopes on others saying "yes" in the future.

NEW!
from Kearney



ARI-60 ..a distribution load break switch with power class features

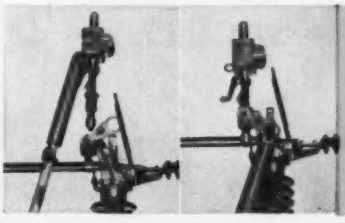
The ARI-60 will greatly extend flexibility in system switching with low cost interruption of load, line charging, magnetizing or capacitive currents. Exhaustive testing in the Kearney Laboratory has proved consistent interrupting ability up to full 600 ampere rating.

PRICE? You'll be pleasantly surprised . . . this is the answer to low cost load switching.

ARI-60 Specifications and Features

- High Speed interruption independent of operator.
- Simple Hot Stick replacement of interrupter.
- Interrupts load currents to 600 amperes without external arc.
- Rotating blade breaks ice, dirt, or corrosion.
- High pressure silver-to-silver contacts.
- Weatherproof rotating stack . . . stainless steel ball bearings.

Featuring the
ARCO INTERRUPTER UNIT



Simply and easily replaced in any position with a hot stick, cannot be installed incorrectly. Locking action holds unit so it can't vibrate free . . . *tested to 50 full load operations.*

For full details ask for Bulletin Section 8c.

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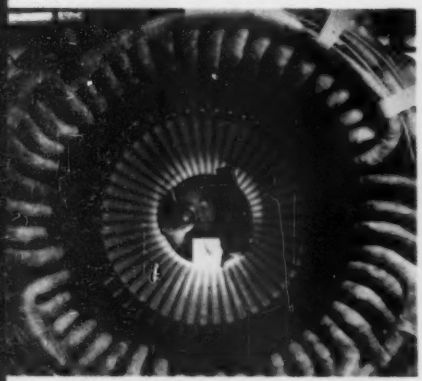
Westinghouse supplies all these vital mechanical components for nuclear reactor plants

Canned Motor Pumps. This skilled technician is machining a canned motor pump shell and flange on a modern 100" vertical boring mill. Pump is an important nuclear reactor component.



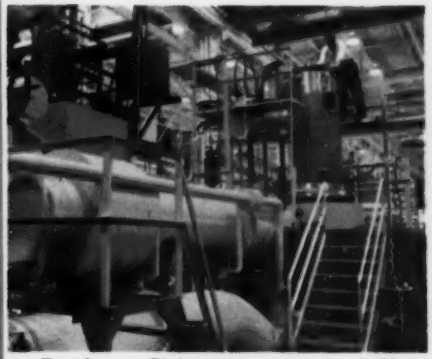
Quality Control. All equipment manufactured by the Atomic Equipment Department is subjected to maximum quality controls. Stringent hydraulic, electric and mechanical inspections result in essentially maintenance-free performance.

Nuclear Reactor Valves. This 20" motor operated gate valve has been machined and is ready for testing before shipment for SELNI in Italy. Valve is one of many Westinghouse designs for reactor plant primary systems.

Modern Production Facilities. Advanced production and testing equipment in modern plant at Cheswick, Pa., make Westinghouse Atomic Equipment Department the most complete facility of its type in the world.

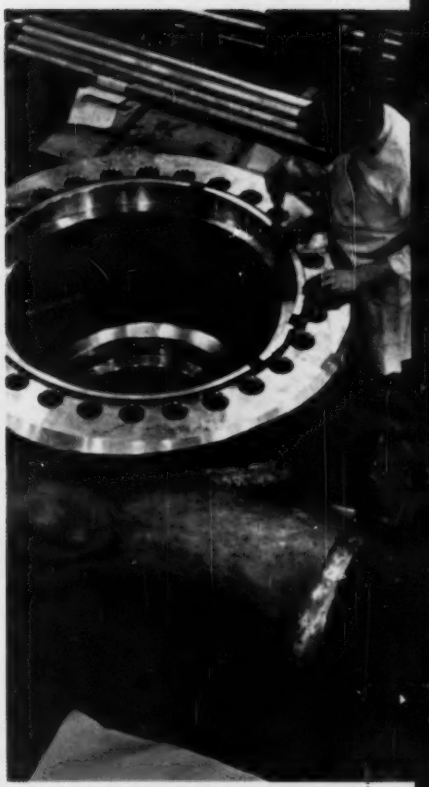
Control Rod Mechanisms. Inspector is working on a control rod mechanism to be installed in new Saxton, Pa., reactor. Moving parts of mechanism are hermetically sealed.

...and canned pumps for controlled circulation boilers

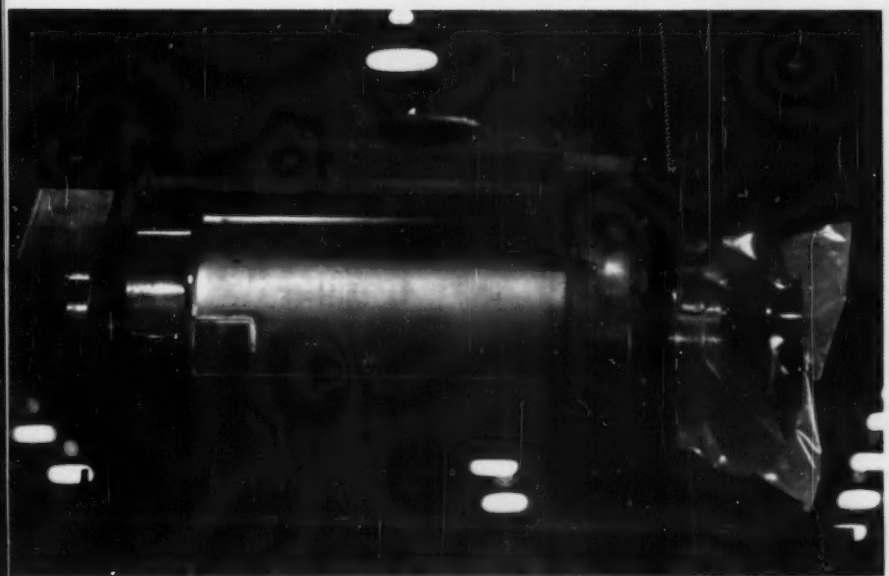


Test Loops. Eight test loops are available at the Atomic Equipment Department for rigid testing of all products. Loops can be adapted to handle flows from 1 to 40,000 g.p.m.

Westinghouse Pumps Installed. Three Westinghouse canned motor pumps are shown installed in power plant in Hartsville, South Carolina. Motor and pump casing completely enclose the pump shaft, eliminating the problems of the seal-injection system.



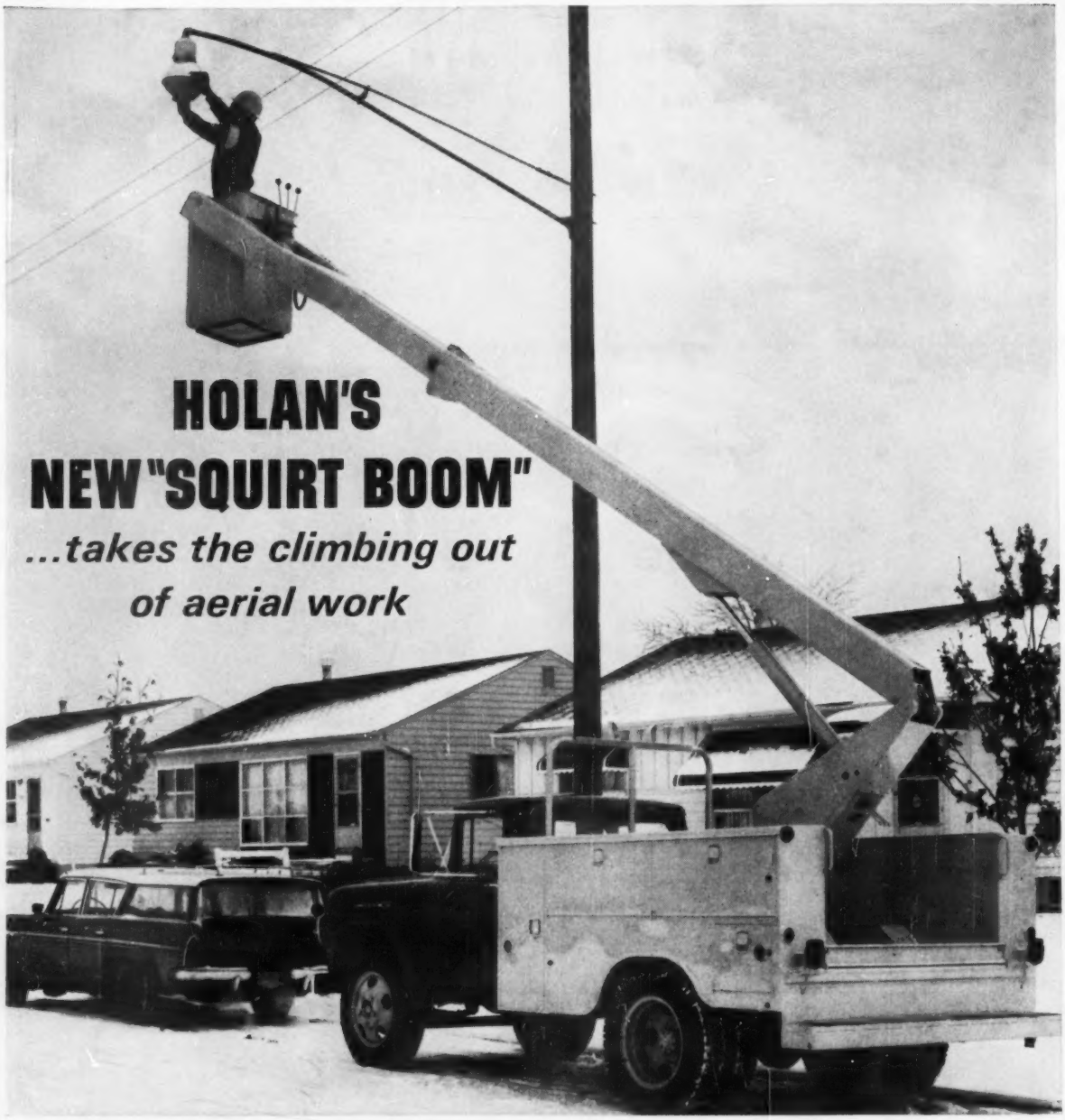
Pump Casing. This nine-ton steel casing will be installed with a canned motor pump in a nuclear reactor plant. Casing and pump form a leakproof unit.



Controlled Circulation Boiler Pumps. Westinghouse manufactures canned motor pumps such as this for service with Combustion Engineering controlled circulation boilers. Standardized pumps are available in many head and flow combinations for these high temperature, high pressure boilers.

J1-58005

Westinghouse



HOLAN'S NEW "SQUIRT BOOM"

...takes the climbing out of aerial work

Here it is — Holan's new all-hydraulic Squirt Boom. Ideal for troublemen . . . the fast, safe way to re-fuse transformers. Saves money in group lamp replacement work . . . no climbing up and down a ladder and material and equipment ride in the bucket with the man. Speeds such work as installing electric service, mid-span taps, traffic signal and street light maintenance.

Now one man can do many aerial tasks because he has complete control with levers mounted on the fiberglass bucket (boom and bucket tested at 73,000 volts (A.C.) bucket-to-ground). Telescoping fiberglass boom extends 10'7". . . raises to a 40-foot working height . . . rotates 360° in either direction. A hydraulic slave cylinder, located in fiberglass bucket yoke, keeps bucket level at all times.

Safe, dependable master-slave type controls are mounted on the bucket and on superstructure. Offset superstructure design and exclusive Holan torsion bars, attached to the body base, provide stability in all positions with a 300-pound payload . . . no outriggers needed.

Let us send you more details on the Holan Squirt Boom . . . designed and built for safe, fast, economical aerial work. Call your Holan Field Representative, or write us.

Holan Corporation, 4100 West 150th St., Cleveland 35, Ohio

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Electrical World

JULY 10, 1961

Management Newsletter

COAL

OIL

NATURAL GAS

HYDRO

NUCLEAR

The Future of Fuels—Part I

Where will fuel prices go over the next two decades? For electric utilities, which feed 36% of their operating expense dollar or 15% of their revenue dollar back into the boilers, this is an important question. The answer is to be found only through a study of some of the basic elements of fuel prices.

How much fuel is available? How will it be gotten out of the ground? How will it be transported to utility plants? What about new transportation methods? And finally, how much will it cost?

To help answer these important questions, *Electrical World* has analyzed, and presents in three Management Newsletters, its interpretations of the fuel outlook for the future. Part I of this series conveys a picture which puts electric energy in perspective with total energy consumption; Part II paints a portrait of technological advances in mining, drilling, and transportation of fuels; and Part III wraps it all up together with possible governmental actions to portray that which is most difficult—future fuel prices.

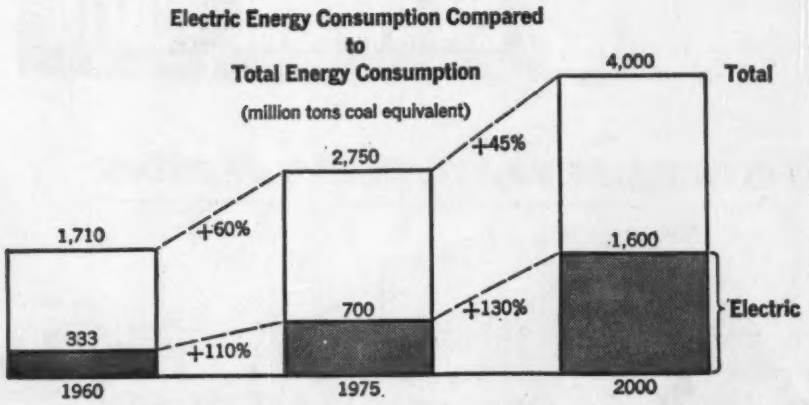
ELECTRIC ENERGY DOUBLES SHARE OF TOTAL ENERGY

Electric energy during the remainder of the century will take a giant-sized bite from the total fuel resources of the nation. The consumer wants it this way. He prefers the clean convenience of electricity over natural gas, coal, and oil, and he's demanding more and more of his energy in this form. How will the utilities meet this demand? Are the fossil fuel supplies adequate? Will they cover the period through 1975? How about the year 2000? What will these fuels cost the utilities?

To answer these questions, utilities must analyze two things: first, the growth of electric energy in relation to the total energy picture, and second, the total availability of natural gas, coal, and oil.

Electric energy's future shines when compared to total energy. Specifically, it will reach two-fifths of the total energy market by the turn of the century. This is double that of today when only one-fifth of total energy is converted into electricity. In the next 40 years, we shall see electric energy consumption go up eight times but total energy consumed will go up only 2½ times.

The judgments of authorities in the energy field provide the basis for such statements. Sam Schurr of Resources for the Future says that energy consumed as electricity, now at 20%, will grow to 24% of the total by 1975. Philip Sporn of American Electric Power shows that this will grow to 40% by the year 2000. In other words, electricity will take twice as much of the total as today.



FUEL CONSUMPTION for generating electricity takes two-fifths of total consumed energy in year 2000. Numbers below dotted lines show percentage growth

Electric utilities will be Mr Big in the energy business. What does this imply? First, federal fuel policies will affect electric utilities more as the years pass. Second, availability of fuel resources will vitally concern electric utilities. And finally, one fuel supplier—coal—will be heavily dependent on electric utilities, and vice versa.

KING COAL WILL REIGN

How much will coal be dependent on electric utilities? Which other fuels may fire the furnaces? How much of each fuel will be needed? Will there be a shift in fuel type as the years go by? Answers to these questions form two strong conclusions:

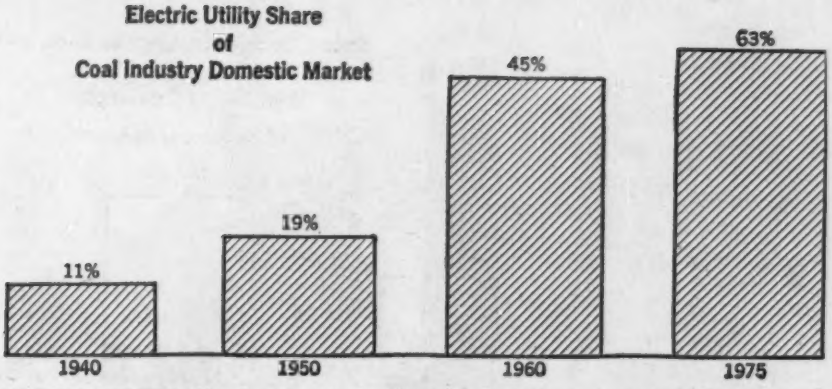
- **King Coal will reign** ever more strongly until about 1980. He will fire much of the new generation in natural gas and oil areas of the country.
- **Nuclear may begin a fast rise** about 1980 and may take over the throne by the end of the century.

An impression of the growing reliance on coal develops from the following quick summaries. C. N. Phillips of Ebasco Services, Inc, as early as 1957, showed that electric utilities in the gas states of Texas, Oklahoma, Louisiana, and Missouri will consume 52 million tons of coal in 1975. A recent *Electrical World* survey shows that 14 electric utilities scattered throughout the nation expect, from 1960 to 1980, to increase coal consumption 270%, natural gas 80%, and hydro 18%, but oil consumption will actually go down 15%.

Coal consumption will go up 7% per year for nine East and Midwest electric utilities which consume 20% of total electric utility coal, according to a noted coal consultant. Some of these utilities project coal growth rates as high as 8%. Sporn says that electric generation from coal will grow 190% from 1957 to 1975, that of oil only 58%, gas 23%, and hydro 33%. In this estimate, nuclear makes up 7% of total electric energy in 1975. Finally, Schurr, of Resources for the Future, shows electricity produced from coal growing from 70% of utility thermal generation in 1955 to 74% in 1975.

This growing use of coal for electric generation has turned electric utilities into coal's biggest customer. Utility coal has moved from a minor to the major market in a short period of time, helped by the decline in home and railroad use of coal. Coal will be even more sensitive to utility fuel consumption in the future.

Coal will clearly feel the growing use of nuclear fuels since it supplies the major part of the fuel for electric generation. Since nuclear is expected to rise dramatically in the 80's, coal's growth will slow down. By the end of the century, nuclear will surpass coal as the major fuel for generating electricity. Coal will still grow, but slower.



ELECTRIC UTILITIES take growing share of coal industry output at same time as coal takes growing share of electric energy output, makes cooperation desirable

Nuclear impact on coal can be gauged from this: a nuclear plant of about 300 Mw will supplant about one million tons of coal annually. A number of units of this size can cut the coal consumption appreciably and make an impact of some magnitude, though not nearly enough to upset the upward trend in coal consumption.

ARE FUEL SUPPLIES ADEQUATE?

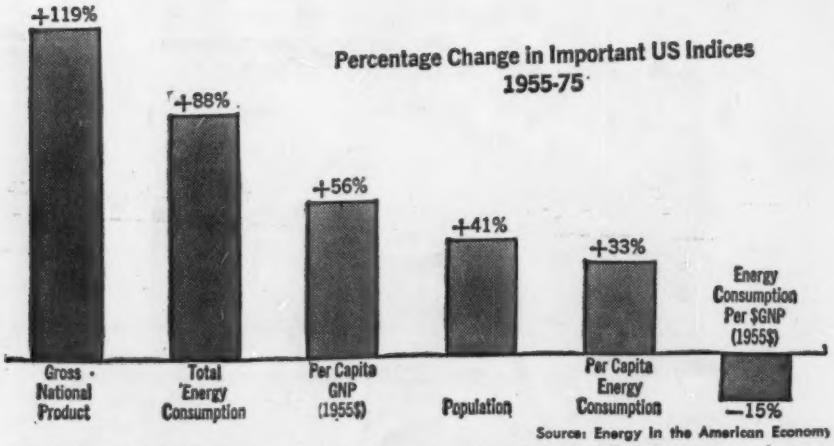
Now since electric energy is taking a bigger slice from the total energy consumption, electric utilities naturally ask—Are the fuel supplies adequate to cover the period through 1975? How about the year 2000?

Clearly, yes for the short range through 1975. Domestic resources are ample enough to satisfy US demands. Reserves—discovered resources which can be mined or pumped at current costs—are 12½ years for oil, 21 years for natural gas, and hundreds of years for coal, expressed in terms of 1959 production. Advancing technology is making more of the resources available and thereby maintaining reserve levels, except possibly in natural gas.

Reserves are stretching because the composition of the economy is changing so that more Gross National Product can be produced with less energy. Schurr of Resources for the Future finds that GNP will increase 119% but energy consumption will go up only 88% from 1955 to 1975. Energy consumption per unit of GNP will actually decrease 0.8% per year. This downswing in energy consumption per GNP unit appears to be closely related to changes in GNP composition, improvements in the efficiency of using energy, improvements in the over-all productivity of the economy, and in the electrification of industry. The over-all effect is that total energy consumption goes up 3.2% per year and per capital energy consumption goes up 1.4% per year when GNP increases at 4% per year. Nothing yet indicates a change in this trend.

But the energy picture to the end of the century is thorny, even though this is a long way to estimate. Total fossil-fuel resources are adequate to satisfy US consumption for the rest of the century. These are over seven times expected consumption. Nuclear energy will decrease fossil-fuel needs and further stretch resources.

But natural gas may near exhaustion by the turn of the century. Even natural gas which costs a lot to find and get to the consumer will near its end. Oil still has a way to go, but it will have to come from shale and tar sands, thereby increasing its cost because the job of getting it out of the ground and refining it is more complicated. Coal and lignite, however, will meet their needs easily. In fact, coal and lignite alone could supply all fuel needs for the rest of the century with ease, says F. Searl of the Atomic Energy Commission.



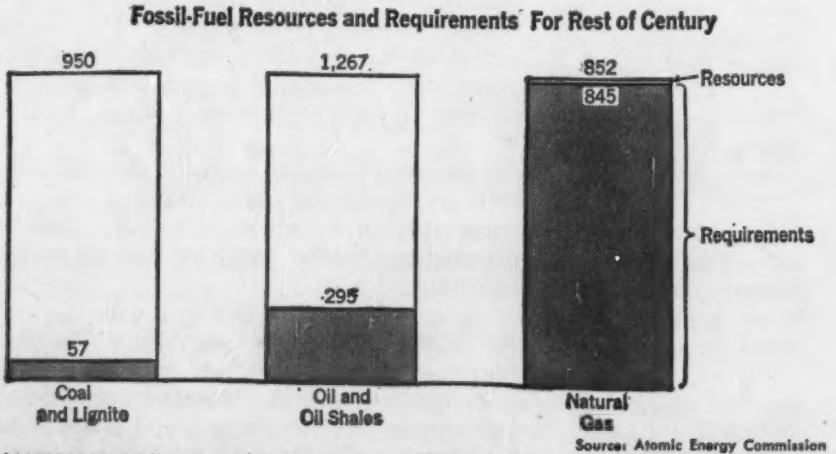
US GROWTH INDICES show that total energy consumption will not grow as fast as Gross National Product. Energy consumed per GNP$ goes down 0.8% per year

CEILINGS HOLD DOWN PRICES

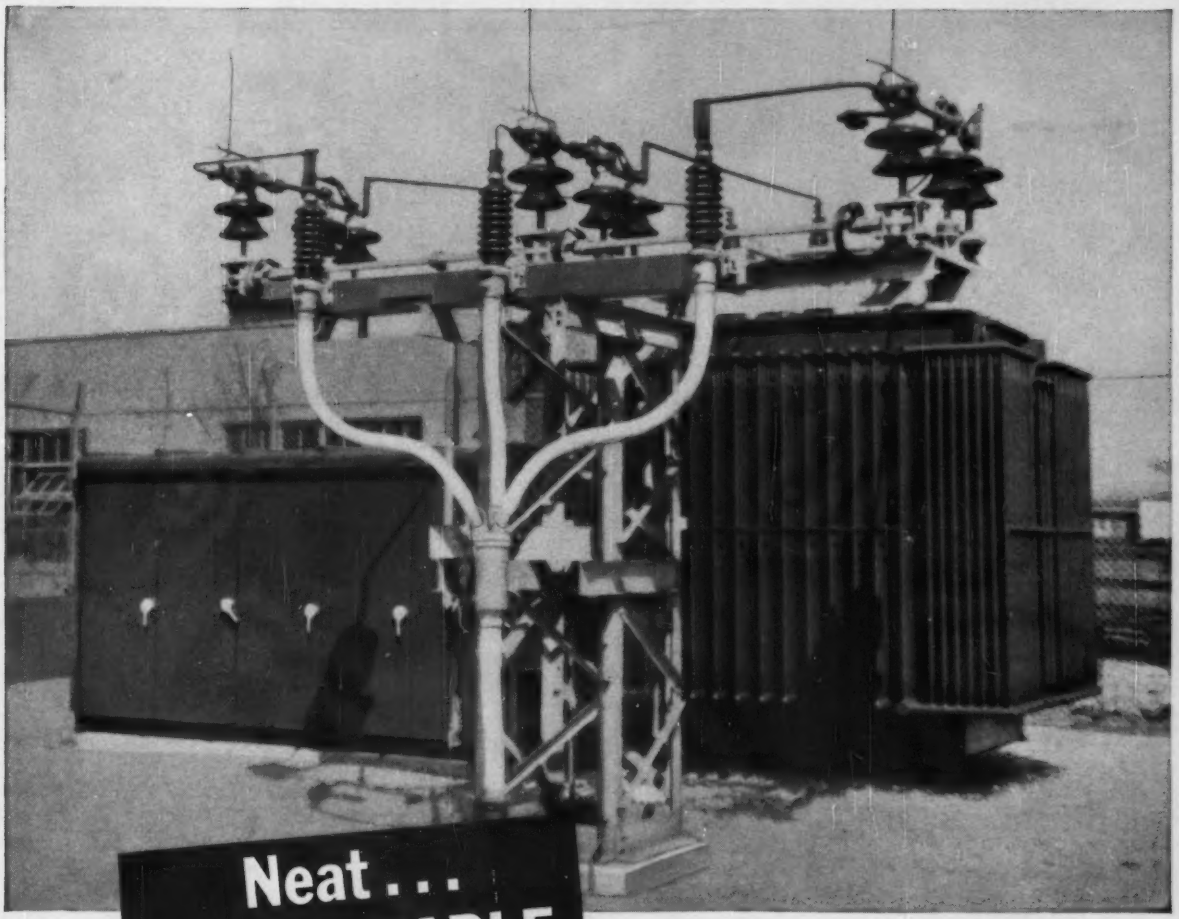
The long-range picture clearly contains pressures which will drive natural gas costs up faster than oil, and oil costs up faster than coal. But three factors—fuel imports, nuclear energy, and technology—set ceilings on domestic fossil-fuel costs and prevent them from running wild. Fuel imports are subject to government restrictions. If domestic oil goes far above foreign oil costs, it will be difficult to hold such restrictions. But, foreign costs may rise faster than domestic costs and not place a ceiling on domestic costs within two decades.

Nuclear energy, through electricity, will impose a constantly lower ceiling on coal as well as natural gas and oil costs. Its effect will spread as the ceiling is lowered by advances in the nuclear industry. This pressure will become most effective starting in the 70's. Technology, the third factor to control fuel costs, will come into play in developing processes to convert coal and shale oil into gas and oil. This may occur when the difference in cost of coal, oil, and natural gas become large enough to justify development of these processes.

Fuel prices are vitally affected not only with fuel availability but also with the cost of getting fuel out of the ground and to the power plants. An element of these costs is mining, drilling, and transportation technology. The next Management Newsletter will portray technological advances in these fields.



NATIONAL GAS nears exhaustion by year 2000. Coal is billions of tons, oil is billions of barrels, and natural gas is trillion cu ft. For comparison, energy value of total coal resources is about three times those of oil, and 23 times those of natural gas



Neat... and RELIABLE

This industrial transformer load-center was installed in minimum time, requires little space, and presents an exceptionally neat appearance, largely because circuits were brought in underground and there are no overhead wires and few structures.

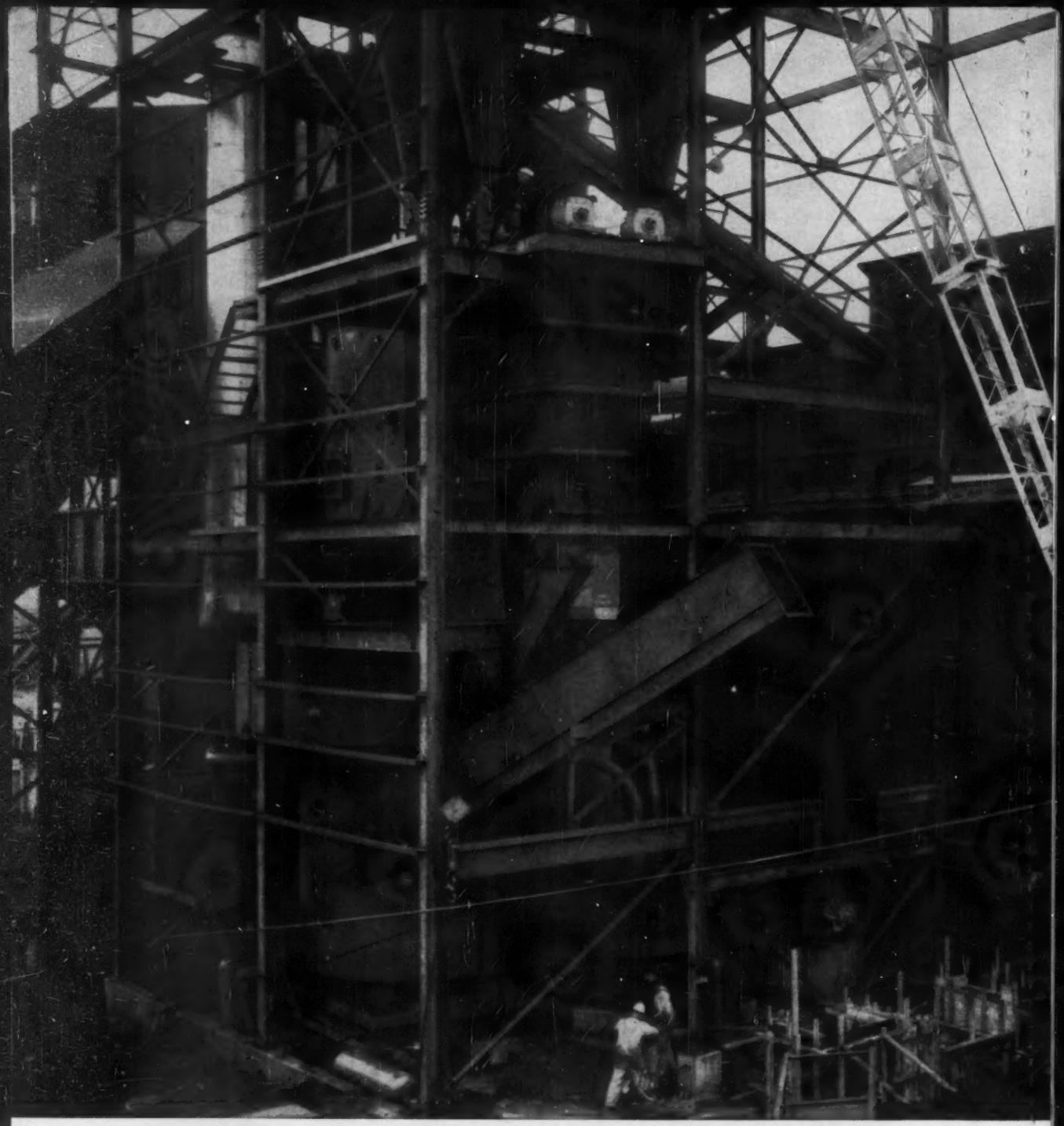
Standard G&W "ST-Sodertite" Potheads were used to terminate the 34.5-kv primary supply to this transformer station for long-time reliability. Type "ST" Potheads are permanently sealed at the factory by metal-to-porcelain soldered joints thus reducing the number of field operations necessary to seal the pothead against weather. Semi-conducting glaze on the porcelain between bottom petticoat and wiping sleeve controls longitudinal dielectric stresses of the cable termination. Extra internal creepage distance provided by closed hood and simple ferrule design further enhance reliability. Spun copper wiping sleeve and hood eliminate possibility of porosity, assuring maximum protection.

Get all the facts about standard G&W "ST-Sodertite" Potheads from your G&W representative or by writing for Bulletin AA56.

G & W ELECTRIC SPECIALTY COMPANY
3500 WEST 127th STREET • BLUE ISLAND, ILLINOIS
CANADIAN MFR. • POWERLITE DEVICES LTD. • TORONTO, MONTREAL & VANCOUVER

superior quality standards — inspired specialized design

A-61-2

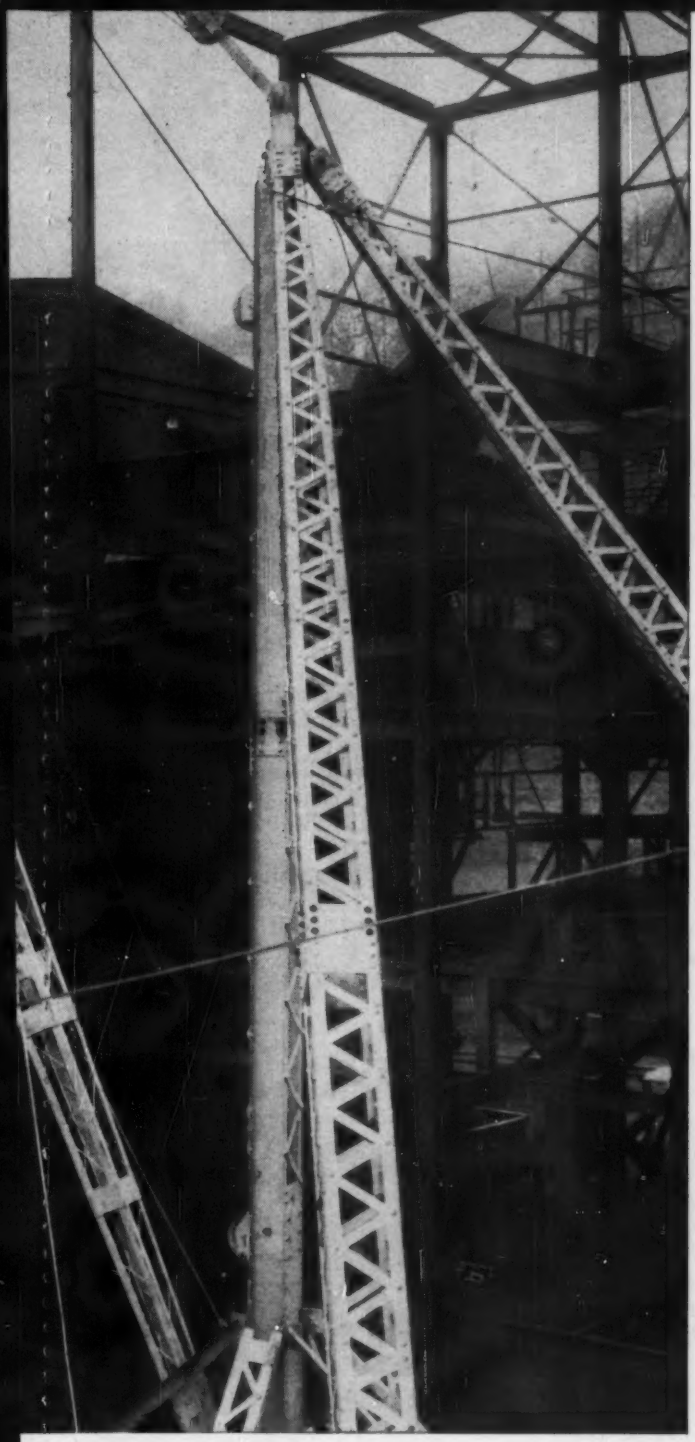


Progress Report: *Eastern's new cleaning plant at* ***Federal No. 1 mine, Grant Town***

ON SCHEDULE

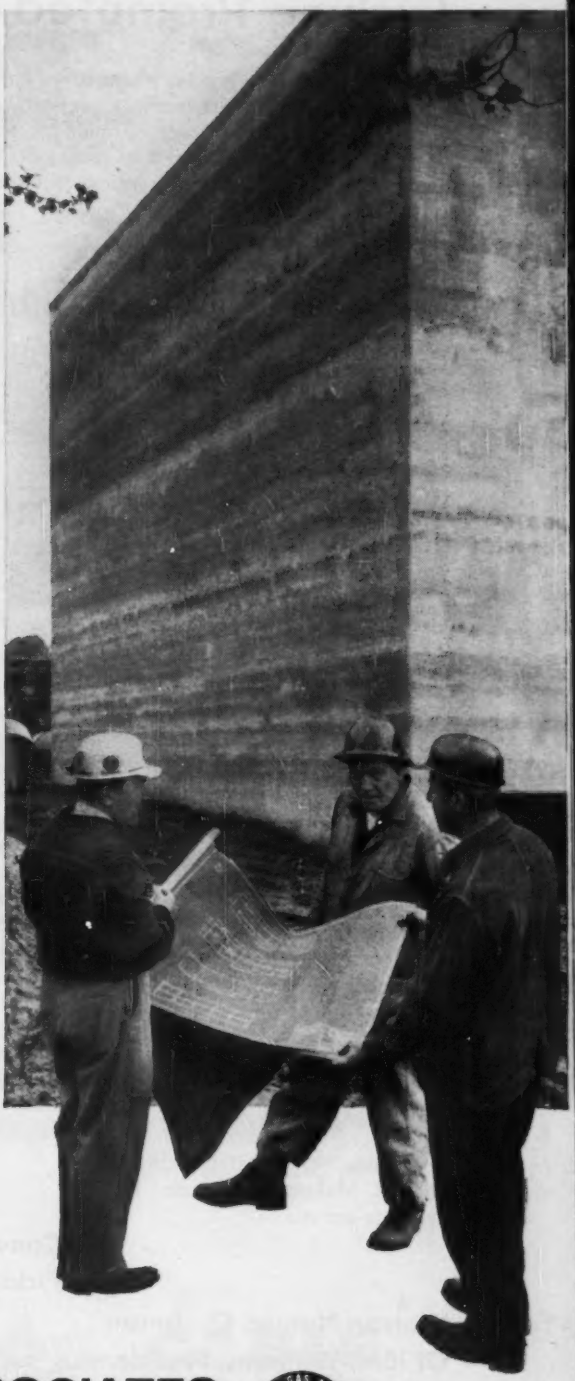
The construction of the new coal cleaning plant at Eastern's Federal No. 1 mine, Grant Town, W.Va., is proceeding on schedule.

Designed by Eastern's own engineering staff, the new plant will employ the most modern equipment, so arranged as to provide uninterrupted production at all times. This plant will produce a very high grade of steam coal.



(Left) Main plant showing the dryer at left, pulverizer (at base of dryer) and part of the dust collector system.

(Below) Company and contractor personnel check progress of 2500 ton capacity blending bin adjacent to main plant.



Federal No. 1 is one of a series of such cleaning plants now under construction or in the planning stage. These plants are evidence of Eastern's determination to continually improve their product and their service to customers.

If you would like a full description of the facilities at Federal No. 1, write or phone your nearest Eastern representative.

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News About People

LUCKING

Lucking Promoted to VP

Frank E. Lucking has been elected commercial vice president of California Electric Power Co.

Lucking has been commercial manager for the past three years. As commercial vice president, he will be responsible for the company's sales, customer services and public relations activities.

With the utility since 1924, Lucking was district manager of the company's Perris-Elsinore operations from 1942 to 1958, when he was appointed commercial manager.

J. R. Kearney Corp, Hubbard & Co Make Wenner Chairman

WENNER MORRILL

Charles P. Wenner has been elected chairman of James R. Kearney Corp of St. Louis and Hubbard & Co. John R. Morrill, Hubbard president, was named president of Kearney.

Wenner, president of Kearney for the past two years and a director of Hubbard, succeeded Franklin H. Kissner. Former chairman of the two companies, Kissner resigned but will remain a director of both.

Wenner has been with Kearney 32 years. Morrill joined Hubbard two years ago.

Kearney and Hubbard are affiliated through the Dyson interests in New York.

Kelly Gets Puget Sound P&L General Manager Post

Emmet P. Kelly has been promoted to general manager-operations and engineering for Puget Sound Power & Light Co.

KELLY

He has been with the company since 1929 when he joined as a student engineer. He was most recently assistant manager of operations and safety director. John E. Makovich succeeded Kelly as safety director.

Watson Named Chairman Of IBM; Williams, President

Thomas J. Watson Jr has been elected chairman of International Business Machines Corp. Albert L. Williams succeeded him as president. H. Wisner Miller Jr became vice president and group executive.

Warren C. Hume became president of the data processing division, replacing Gilbert E. Jones who was appointed assistant to the president.

Also, Jerrier A. Haddad was promoted to vice president and assistant general manager of the data systems division, and George A. Kennard became general manager of the advanced systems development division. Dr Charles R. DeCarlo was named education director.

Canadian A. B. Chance Co Picks White as President

A. B. Chance Co of Canada, Ltd, has elected William H. White president and treasurer. Robert T. James was boosted to vice president in charge of sales. The company is a subsidiary of A. B. Chance Co, Centralia, Mo.

White has been executive vice

WHITE JAMES

president of the Canadian corporation since it was organized in 1955. James has most recently been sales manager.

Dr Schubert Heads GE's Transformer Department

Dr A. Eugene Schubert has be-

(*More News About People, p* 106)

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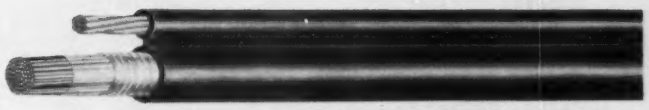
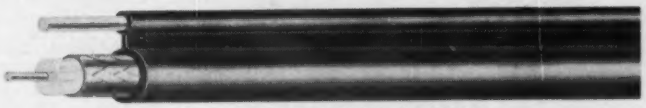
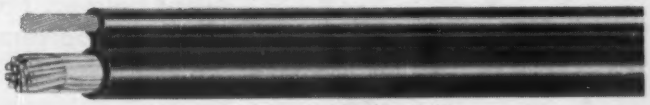


Supervisory Control Cable
for critical control and communication circuits.



Coaxial Distribution Cable
for closed circuit TV systems.



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5579

NEWS from LAPP

Hi-F

FOR TODAY'S TRANSMISSION REQUIREMENTS THE FIRST "FUNCTIONAL DESIGN" SUSPENSION INSULATOR IN MORE THAN A GENERATION

See next week's Electrical World

come general manager of General Electric Co's power transformer department, Pittsfield, Mass. Formerly general manager of the chemical materials department, Schubert succeeded Gerald A. Hoyt who received a special assignment in General Electric's defense business.

SCHUBERT

McCLURE

McCORMICK

Three Get Advertising, Public Relations Posts

Babcock & Wilcox Co has made Edward M. McClure manager of equipment advertising and sales promotion, and James H. McCormick, corporate advertising and publications manager. James O. Trudeau became manager of public relations services. All three will retain headquarters in Babcock & Wilcox's New York offices as members of the staff division.

TRUDEAU

Allis-Chalmers Promotes Geist to Department Head

Kenneth R. Geist has been appointed general manager of the newly formed special products department of Allis-Chalmers Manufacturing Co.

Fred J. MacDougall has succeeded Geist as purchases director.

GEIST

I-T-E Picks Gryctko for Small ACB Division Spot

Carl Edward Gryctko has been boosted to engineering manager for the small air circuit breaker division of I-T-E Circuit Breaker Co.

Gryctko joined I-T-E in 1949 as a field engineer for the transformer and rectifier division. In 1954 he became head of the small air circuit breaker division's test laboratory and, last year, was named head of its development program.

GRYCTKO

PERSONAL BRIEFS

Paul R. Welch has been appointed assistant to the president of Narragansett Electric Co.

Tennessee Valley Authority has promoted **Robert T. Hosmon** to western district manager, replacing **A. P. Brazelton** who resigned to become municipal power system manager in Paducah, Ky.

Northern States Power Co has made **J. W. Hoffmann** executive assistant to the public relations vice president; **V. A. Frawley,** fuel procurement manager; **D. W. Angland,** system planning general superintendent in the new system planning department; **A. W. Benkusky,** system planning engineer; and **F. J. Vojta,** assistant system planning engineer.

Iowa Public Service Co has made **Mack Gardner** controller; **John Carlson,** assistant secretary; and **Charles Dold,** assistant controller.

Ray Perry has stepped into the post of manager of Kittitas County PUD, replacing **H. A. Fleming** who resigned.

Wisconsin Electric Power Co has promoted **Roy A. Green** to power supply superintendent and named **Victor A. Wrangofski** as his assistant. Both are in the electric distribution department.

(*More News About People, p* 108)

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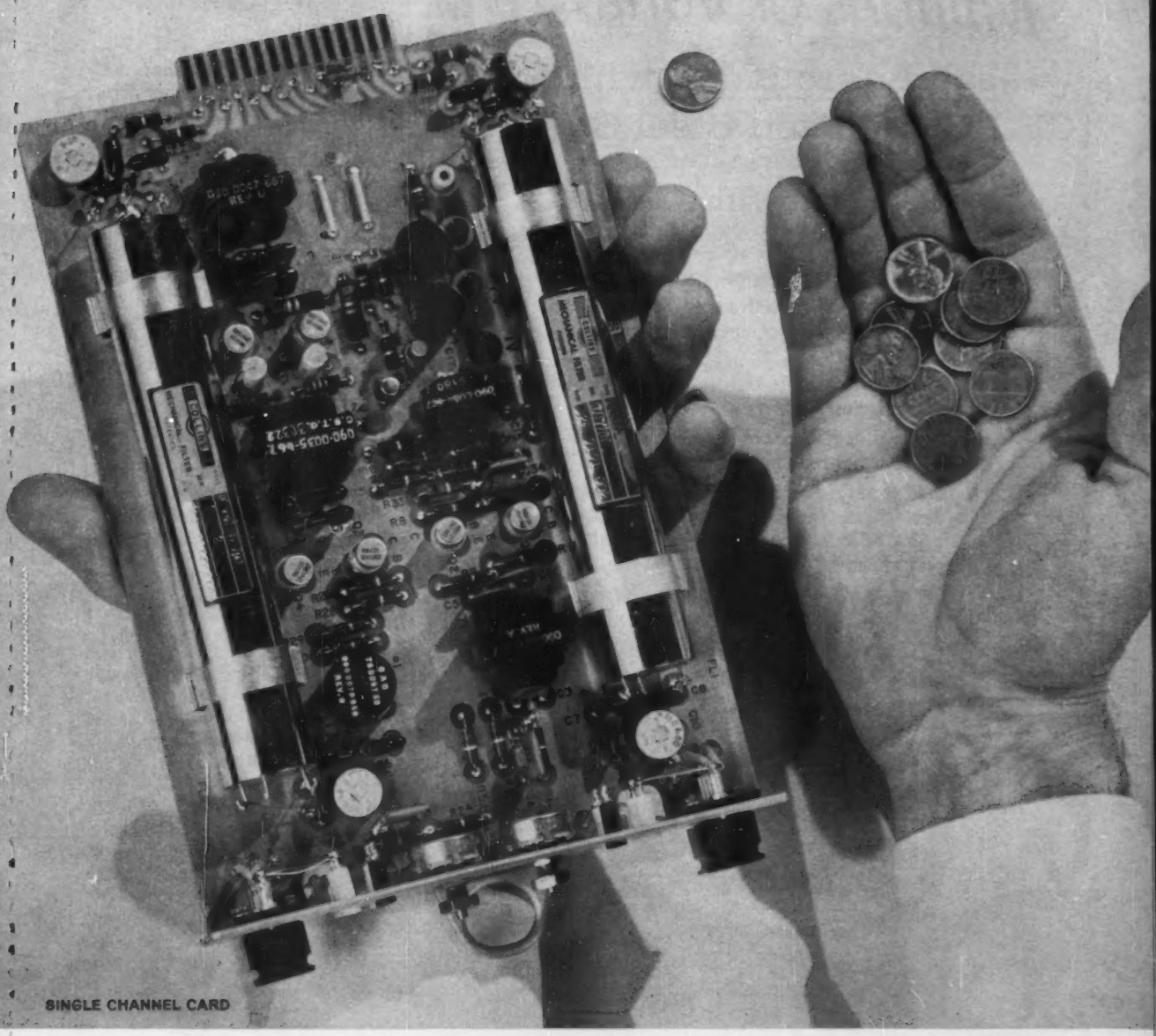

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Now... the freedom of maintenance and reliability inherent in transistorized equipment, at a saving of up to 90% in power and 80% in rack space over tube equipment. This is Collins new MX-106 fully transistorized carrier. Either in microwave, wire or cable systems — or any combination of these — the new multiplex is compatible with Collins MX-103, Western Electric L-Type, CCITT, and other carriers. Its design permits easy and economical expansion to meet changing requirements. For details, write Collins Radio Company, Texas Division Sales, 1930 Hi-Line Dr., Dallas 7, Texas.

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CF&I STEEL MADE IN U.S.A.

E. S. Fields, Cincinnati Gas & Electric Co president, and **Harold R. LeBlond,** a company director, have been awarded honorary Doctor of Law degrees from the University of Cincinnati.

Last month also saw these industry figures receive honorary degrees: **Frederick Carlton Gardner,** president of Ebasco Services Inc, was awarded an honorary degree of Doctor of Science from North Carolina State College; **L. F. Hickernell,** vice president-engineering for Anaconda Wire & Cable Co, received an honorary degree of Doctor of Engineering from Polytechnic Institute of Brooklyn; and **Henry L. Logan,** vice president-research for Holophane Co, Inc, was awarded an honary degree of Doctor of Laws from Iona College.

Oliver B. Lyman has been elected president of Electrical Equipment Representatives Assn. Others elected were: **Curtis H. Stout,** executive vice president; **H. Jack Belcher,** second vice president; **Thomas M. Salisbury,** secretary; **Jack D. Tate,** treasurer; and **H. J. Randolph,** director.

Dr Robert B. Blodgett has been appointed research director of Okonite Co. **Richard C. Waldron** became chief engineer of the Kennecott Copper Corp subsidiary.

Gould-National Batteries, Inc, has made the following appointments in its automotive battery sales division: **N. R. Farsje** as vice president-director of automotive and general sales; **Benjamin O. Dalbey** as general sales manager; and **Hale H. Bockstruck** as sales manager of automotive battery brand sales.

Benjamin F. Cheydleur has been named to the engineering staff of Philco Corp's computer division. **Clarence E. Burke** is the division's new general manager.

General Electric Co has made **J. R. Wolcott** manager of the atomic power equipment department's new nuclear electronic products section. **Vaughn D. Nixon** succeeded him as manufacturing manager.

At Allis-Chalmers Manufacturing Co, **Joseph M. Duncan** has been ap-

(*Continued on page* 112)

cut costs with service-proved GC breakers

When the new Westinghouse GC Single Tank Three Phase Power Circuit Breakers (rated 14.4 kv; 100, 250 and 500 mva) were first introduced, tests indicated that they would provide greater protection and require less maintenance and installation cost than the superceded type G breakers. Actual service records now verify these predictions.

Three key features make this performance possible.

First, these GC breakers interrupt essentially within three cycles, from 0 to 100% of rating. This provides greater protection against line and equipment damage due to faults—reduces possibility of line burndown. It also reduces arcing time within the breaker which results in less contact burning and oil contamination and, therefore, less maintenance.

Second, simple solenoid operating mechanism minimizes maintenance.

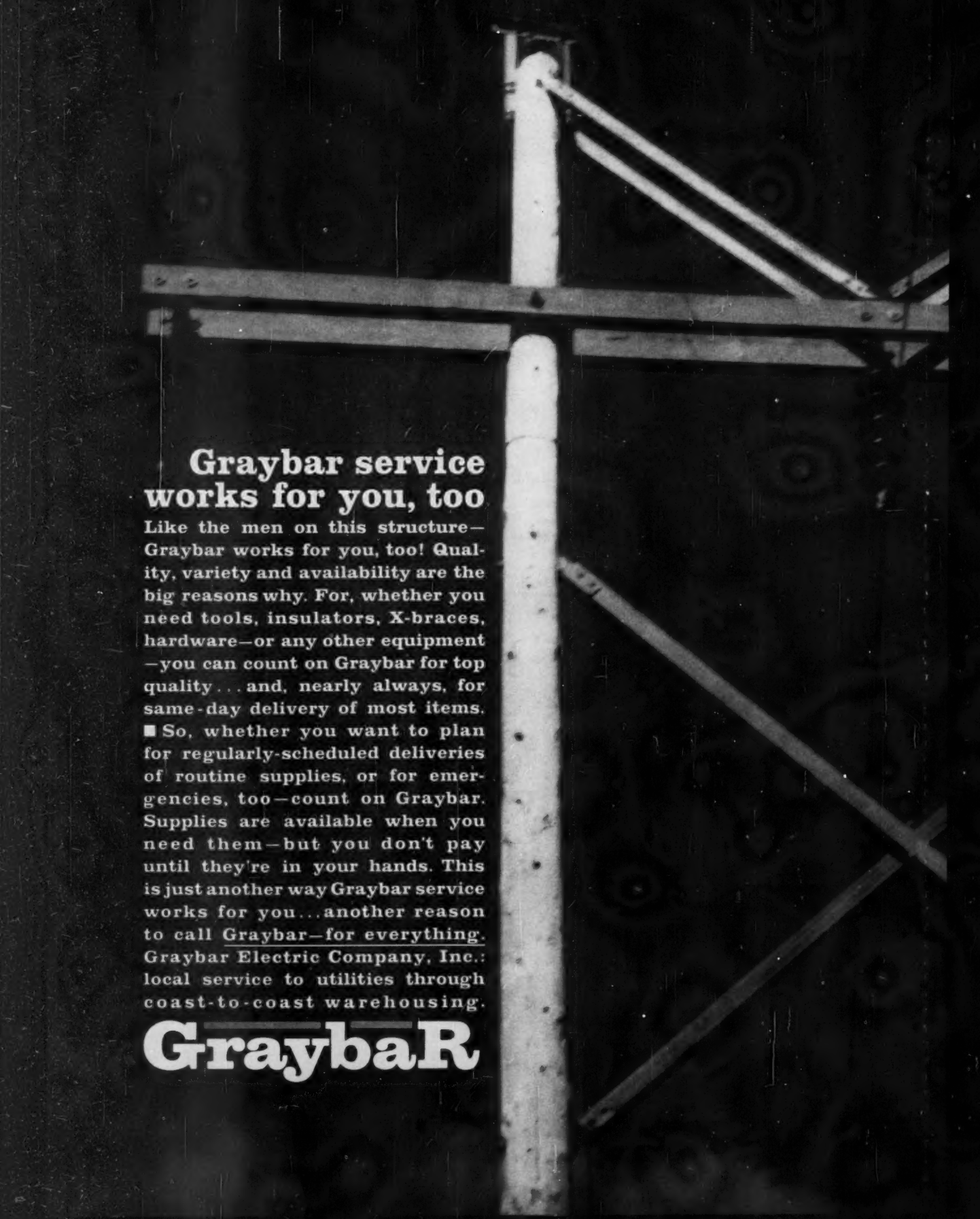
Third, closing current requirements have been slashed to less than one-half compared to units available as recently as three years ago. Result here is lower installation costs since much smaller control cables and transformers or batteries can be used.

For complete facts, call your Westinghouse representative, or write Westinghouse Electric Corporation, P.O. Box 868, Pittsburgh 30, Pa. *You can be sure . . . if it's*

Westinghouse

J. M. Kadetsky (right) of Pennsylvania Electric Company and T. C. Pitzer, Westinghouse Sales Engineer, discuss a 14.4 kv, 100 mva, GC Breaker. A good performance record has been logged by this unit installed in Pennsylvania Electric's Boulevard Substation, Johnstown, Pa.

J-61012



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GraybaR

pointed manager of the industry group's north central region, with

611

NEWS from LAPP

Hi-F

FOR TODAY'S TRANSMISSION REQUIREMENTS THE FIRST "FUNCTIONAL DESIGN" SUSPENSION INSULATOR IN MORE THAN A GENERATION

See next week's Electrical World

pointed manager of the industry group's north central region, with headquarters in Chicago. He succeeded **C. F. O'Riordan,** recently named general manager of the defense products division. In the regulator department, **R. E. Horn** became manager; **J. F. Kulas,** sales manager; and **A. H. Baguhn,** chief engineer. At the Norwood Works, **Ted Merkel** was named application engineer in the pump department, and **Louis E. Welch** became assistant engineer in the dc machine design section of the electrical department. **James J. Dickson** became assistant manager of the nuclear power department-Washington at Allis-Chalmers Manufacturing Co. **Joseph V. Cupo** became engineering manager and **Joseph H. Blachly** was named projects manager, both also in the Washington nuclear powe department.

R. A. Olsen has been named general manager of Electric Autolite Co's wire and cable division.

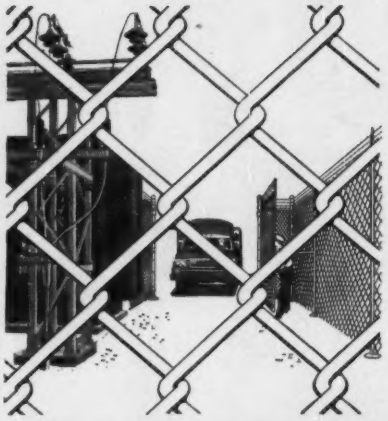
At Thompson Ramo Wooldridge Inc, **Dan L. McGurk** has been promoted to associate general manager and **Louis B. Perillo** to marketing director, both in the TRW Computers Co division. **Q. T. Wiles** became vice president-marketing of the company's Components Co division.

Westinghouse Electric Corp has made **Lloyd B. Kramer** nuclear reactor core development manager in the atomic power department. A new department for the development, manufacture and marketing of molecular electronics functional blocks has been formed within Westinghouse's semiconductor department. The new group will be headed by **Fred M. Heddinger. Dr H. W. Henkels** will be engineering manager; **K. G. Cooley,** manufacturing manager; and **Ozzie Jaeger,** sales manager.

Harry J. Ulkloss Jr has been elected treasurer of Electric Storage Battery Co, succeeding **D. N. Smith** who resigned.

Floyd E. vonOhlen has succeeded **Corliss A. Bercaw** as western special representative of electro-motive division of General Motors.

(*More News About People, p* 114)



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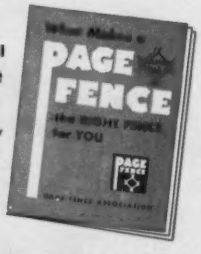

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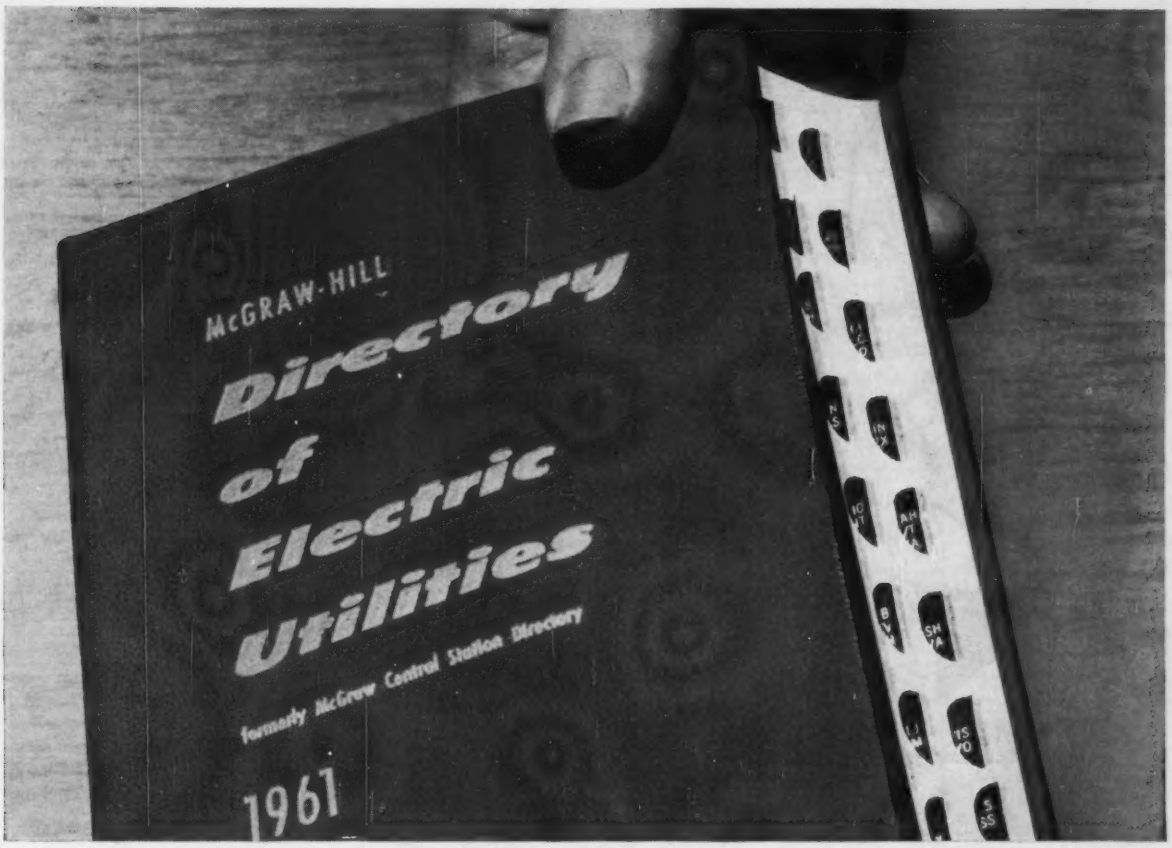

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SALES ASSIGNMENTS

COMPANY STAFFS

Bryant Electric Co has named John R. Commons sales representative for its Houston territory.

Westinghouse Electric Corp has appointed S. Rowe Hill as central regional sales manager for the air conditioning division. He succeeded J. C. Reynolds who joined the division's headquarters marketing staff in the commercial and industrial sales department.

Motorola Communications & Electronics, Inc, has boosted Joseph V. Guido to Pacific Northwest regional sales manager. Succeeding him as account executive in Washington and Oregon is D. Edward Williams. Robert H. Maki replaced Williams as Seattle zone sales manager.

McGraw-Edison Co has named Daniel E. Winslow Jr New York sales district manager for the Pennsylvania Transformer division. E. S. Banghart, who headed the office for 15 years, continues as a sales consultant.

Thomas & Betts Co, Inc, has established four new sales districts. The districts and their managers are: New York district, Eugene W. McGrane; east central district, James J. Boyle Jr; middle Atlantic district, Stanley A. Trezise; and west central district, John L. Schroeder.

Cutler-Hammer has named H. E. Johnson Buffalo sales district manager.

Southern States Equipment Corp has appointed Bruce Smith midwest regional manager, with a sales office in St. Louis. Justin A. Zager, northern regional manager, formerly located in Buffalo, N. Y., was transferred to the factory in Hampton, Ga. M. A. Long was named field engineer and assigned to the southwest regional office in Dallas, Texas.

General Electric Co has opened two new sales offices and added six new district sales managers in its eight-state northeastern sales region for the semiconductor products department. The new sales offices are at 410 Asylum St, Hartford, Conn., and 600 Old County Rd, Garden City, L. I. The new district sales managers are: John J. Skelly, for Connecticut and Rhode Island; James W. Bentley for western New York; John P. Brady for eastern New York above New York City; Carl E. Barrie for the Boston area; and Paul F. Smith for Long Island. The silicone products department opened a sales office in Burlingame, Calif., to cover the San Francisco area; Red Baurmeister is company representative in the office. William E. Hare was appointed sales promotion specialist-Los Angeles district for GE's industrial sales operation. Charles S. Martin has become midwestern sales manager for the insulating materials department. He has offices in Ft Wayne, Ind., and covers the Cincinnati, St. Louis, Chicago, Detroit and Ft Wayne sales territories.

M. W. Kellogg Co, subsidiary of Pullman Inc, has made Robert G. Thompson Midwest regional manager in charge of the new Chicago office for Kellogg's power piping division.

S&C Electric Co has made John A. Schwenke sales engineer for the northern half of Texas.

Hevi-Duty Electric Co has appointed Stuart D. Walker district manager in charge of the new Boston area sales office at 368 Washington St, Dedham, Mass. He will serve the New England states.

H. K. Porter Co, Inc, has made J. C. Maeder western district manager for the national electric division. With headquarters at 6900 East Elm St, Los Angeles, Maeder will be responsible for sales activities of seven branch offices serving 13 Western states. Walter J. Riley Jr joined the company's Philadelphia office of Riverside-Alloy metal division. He will serve customers in the middle Atlantic states.

REPRESENTATIVES

Electric Autolite Co's C&D batteries division has named Irving T. Bartlett Jr to head its sales organization in Jersey City, N. J. He will head Packaged Industrial Power, Inc, C&D's Jersey City representative covering the New York City area, northern New Jersey and Connecticut.

Southern States Equipment Corp has appointed Matzinger-Johnson Co of Los Angeles as representative in southern California.

G&W Electric Specialty Co has named Gregory-Salisbury Co, sales representative in the Arkansas and west Tennessee area, to handle G&W sales in Louisiana and Mississippi also.

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Electrical Engineer, Central Illinois utility has opening in substation design, transmission design and communications for engineer with a degree. Previous experience in these fields desirable. Salary up to $9,000. Send resume of education and experience to P-6973, Electrical World.

Three Chief Operators with Public Utility experience for 80,000 KVA Hydroelectric Plant in East Pakistan. One year contract at $1000 per month with subsistance, housing and transportation furnished. All qualified applicants will be considered without regard to race, creed, color or national origin. Send resume of experience to Utah-Pakistan Inc., 221 Pine Street, San Francisco, California.

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Representative wanted for manufacturer of street lighting equipment, pole line specialties. States of Georgia, Washington, Oregon, North and South Dakotas, Illinois, Iowa. Full particulars. RW-6918, Electrical World.

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Books

How Equipment Is Sold

Marketing Electrical Apparatus and Supplies, by Edwin H. Lewis. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, N. Y. 320 pages, illustrated. Price $9.00.

A very general description of the marketing procedures used by manufacturers of industrial electrical apparatus and supplies is given in this recently published book by Edwin H. Lewis, professor of marketing at the University of Minnesota.

It may well serve as a textbook for college majors in marketing. It will not enlighten those men who have had more than a year's experience with any product line. However, it does draw some very broad outlines of the channels of distribution for such product groups as transmission and distribution equipment, control devices, construction materials, lighting fixtures, and lamps. There are also reports on the various services performed by such industry organizations as the National Electrical Manufacturers Assn, the American Standards Assn and some activities of the Edison Electric Institute.

There is only passing reference in this book to sales of electrical equipment to utilities. A few brief paragraphs are devoted to the relationship of utilities to manufacturers and suppliers.

The book does not take up the current marketing situation relating to utilities and their suppliers.

Books Recently Received

Electromagnetic Fields and Waves, by R. V. Langmuir. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, N.Y. 232 pages, illustrated. Price $9.75.

The Great Organizers, by Ernest Dale. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, N.Y. 280 pages, illustrated. Price $5.95.

British Nuclear Power Stations, by Rolt Hammond. Published by Macdonald & Co, 16 Maddox St, W.1, London, Eng. 184 pages, illustrated. Price 25s.

Electricity and Electronics-Basic, by W. B. Steinberg and W. B. Ford. Published by American Technical Society, Chicago, Ill. 264 pages, illustrated. Price $4.50.

Principles of Illumination, by H. Cotton. Published by John Wiley & Sons, 440 Fourth Ave, New York 16, N.Y. 530 pages, illustrated. Price $12.00.

Introduction to A-C Circuit Theory, by J. B. Earnshaw. Published by St. Martin's Press, 175 Fifth Ave, New York 10, N.Y. 266 pages, illustrated. Price $4.50.

Principles of Public Utility Rates, by James C. Bonbright. Published by Columbia University Press, 2960 Broadway, New York 27, N.Y. 436 pages. Price $10.00.

Dictionary of Mechanical Engineering, by Alfred Del Vecchio. Published by Philosophical Library, 15 E 40th St, New York, N.Y. 348 pages, illustrated. Price $6.00.

Fluorescent Lighting Manual, 3rd Edition, by Charles L. Amick. Published by McGraw-Hill Book Co, 330 W 42nd St, New York 36, N.Y. 406 pages, illustrated. Price $12.50.

Introduction to Electrotechnology, by S. J. Kowalski. Published by John F. Rider, Inc, New York 11, N. Y. 306 pages, illustrated. Price $7.00.

Letters

(*Continued from page 5*)

tions of the Russian program, plus much specific information."

Again, I personally resent the inference that those of us who were part of the United States Senate team were insincere. I will match the sincerity of our group against that of the private utility group at any time. You have absolutely no justification for casting aspersions on the sincerity of the three United States Senators and others who accompanied them on this trip.

Alex Radin, General Manager
American Public Power Assn
Washington 6, D. C.

▶ We acknowledge that the trip was not APPA-sponsored, and we must point out that the other trip was not sponsored by the Edison Electric Institute. As to your second point, your public statements as well as your report support our contention. As to the relative sincerity of the two groups, we stand by our editorial statement.

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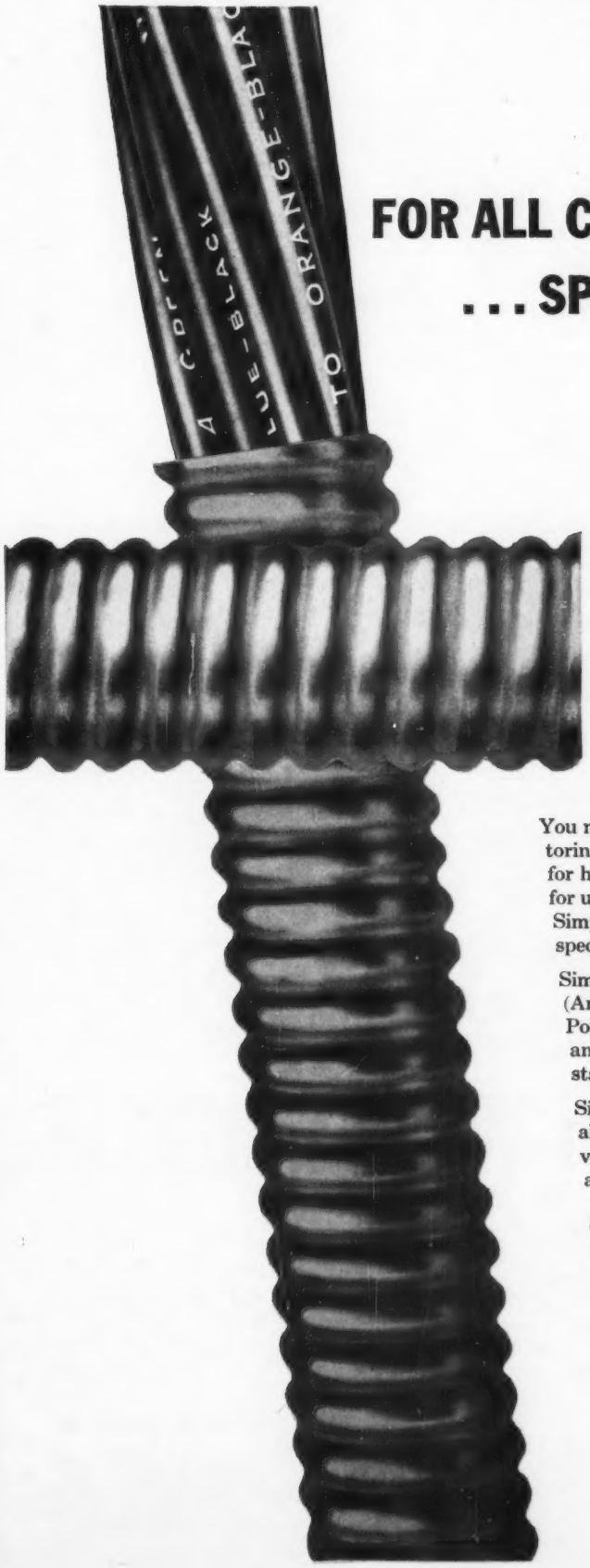

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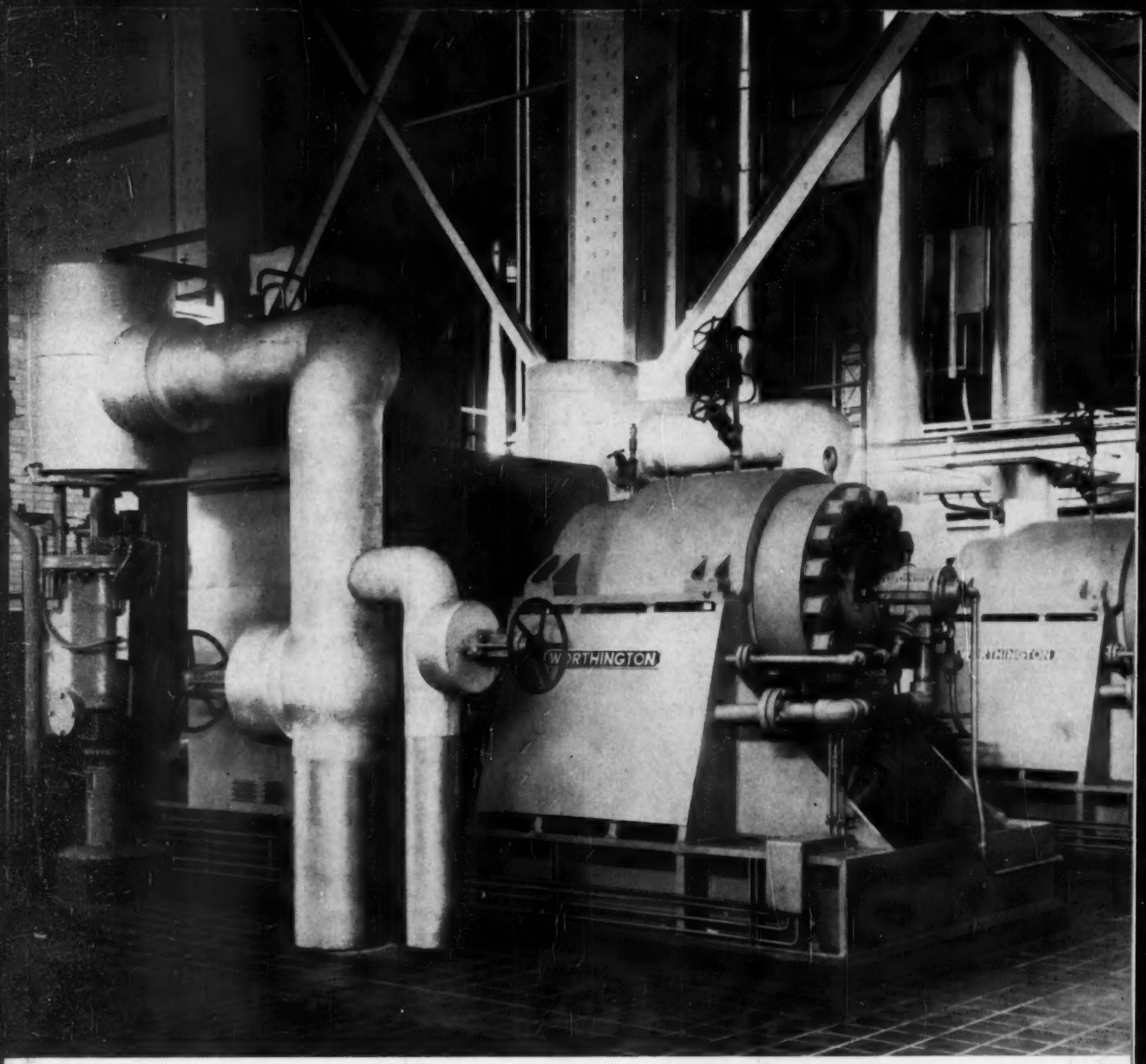

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